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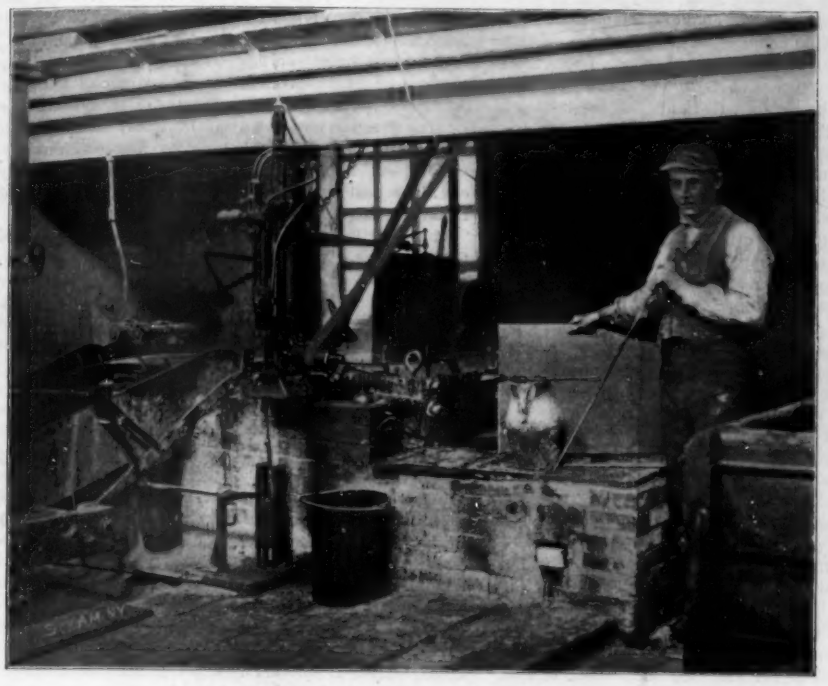
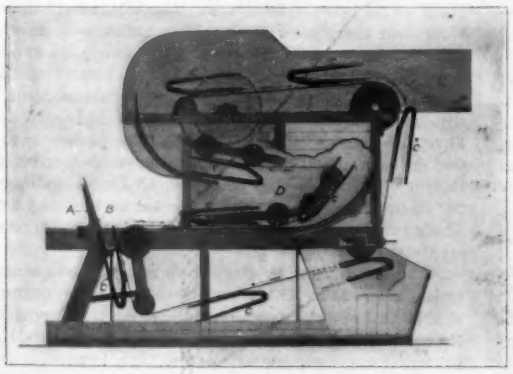
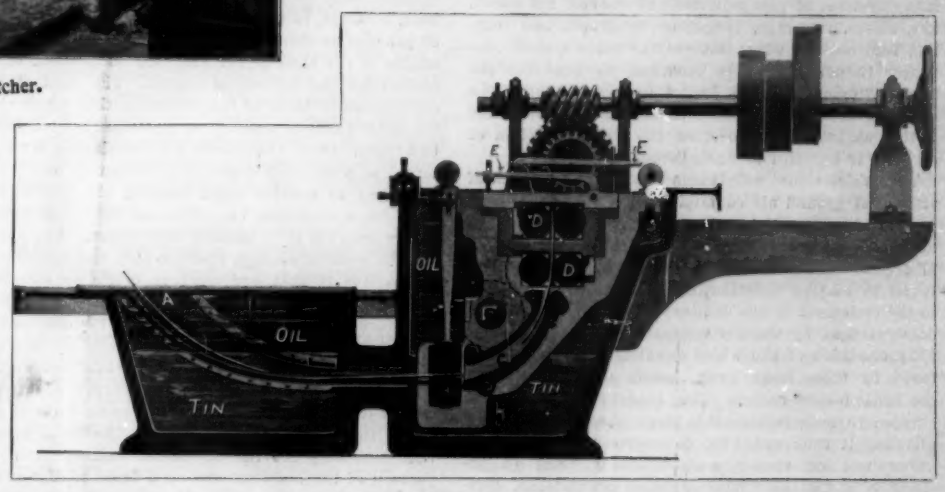


Tinning Machine With Maskrey Catcher.

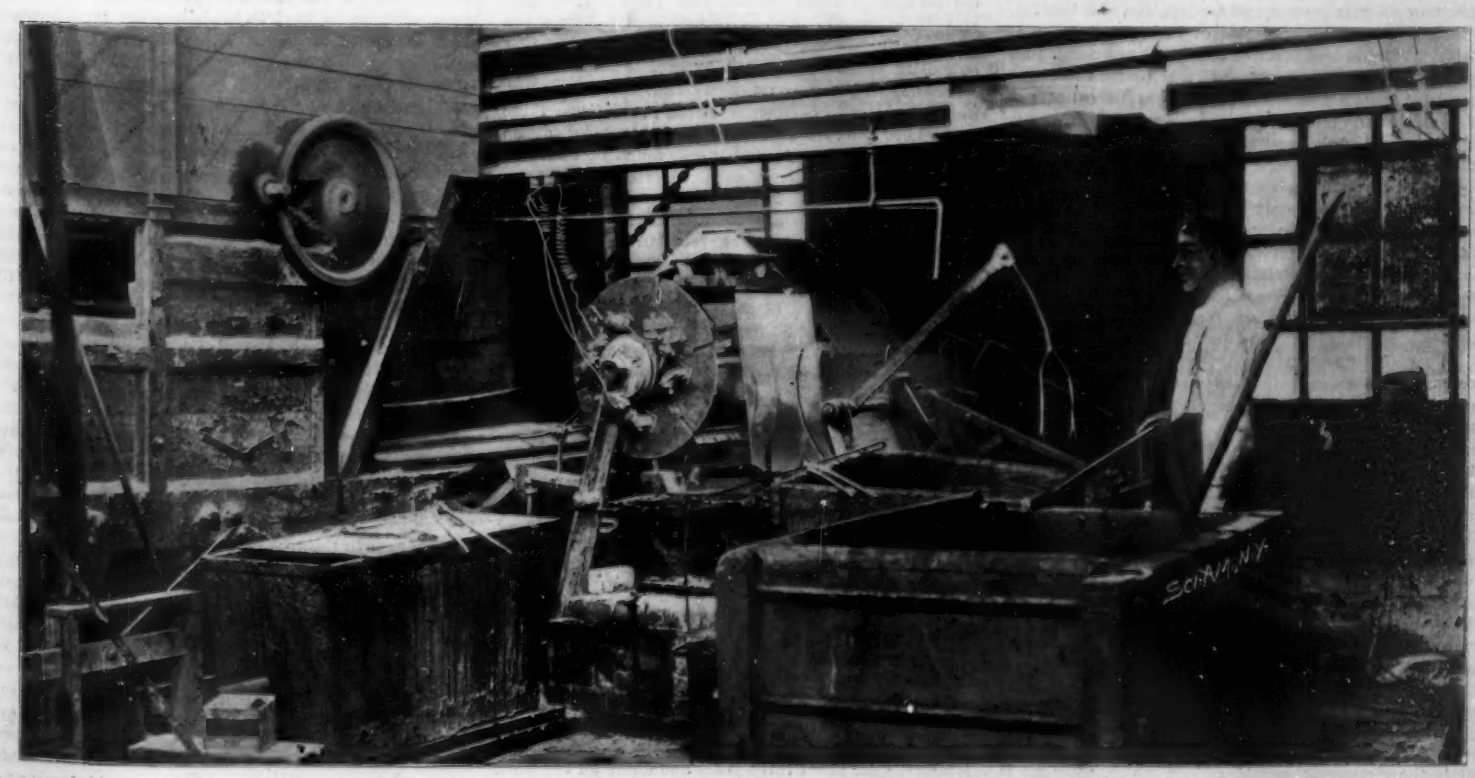
The Tin House, Where Block Plates are Coated With Tin.



The Branner.



Sectional View of Tinning Pot.



Tinning Machine, With Bennett Magnetic Catcher for Removing Tinned Plates as They Come from the Rolls.

THE MANUFACTURE OF TIN PLATE.—II.—[See page 290.]

SCIENTIFIC AMERICAN
ESTABLISHED 1845

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NEW YORK, SATURDAY, NOVEMBER 1, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

STREET VENTILATION.

The solution of the problem of the purification of sub-surface and the lower stratum of surface atmosphere known as ground-air must sooner or later become vital to a city's inhabitants. That the state of the public health may be set forth as the chief asset of a community's prosperity is shown in the presence of an epidemic. Thanks to the high development which sanitary engineering has reached, sewage and ground water drainage is well nigh perfected. The question of surface and ground drainage, while backward in its development, becomes of none the less importance to the engineer, and though dealing with mixtures of gases they are as subject to governing laws of flow and diffusion as is the more stable liquid. In New York city, owing to the great concentration of inhabitants combined with the spirit of progress of our times, manifested by blocks of high buildings which change streets into narrow lanes, the many systems of pipe-galleries and tunnels for water, gas, steam, sewerage, telephone, telegraph, and light and heat electric wires, besides the rapid transit passenger tunnel soon to be installed, all tend for the most extreme conditions for an impressive exhibition of the evil. Street-tunnels, basements and buildings having an intimate connection, the free circulation of all that is harmful is unhindered.

The deleterious substances which are the chief sources of ground air contamination comprise, besides dry, dust-borne particles and matter held in suspension in water vapor, the effluvia arising from decomposition of organic matter and the more demonstrable poisons found in leaking illuminating gas mains. According to the statement of one sanitary expert, it is generally acknowledged by the gas companies of our city that fully one-third of the whole quantity of gas manufactured by them leaks away, before delivery through the house meters occurs. They recognize that it is far cheaper to manufacture this large excess of gas and allowing it thus unheeded to contaminate the lower atmosphere of streets and buildings than to attempt to make tight mains or house connections. Furthermore, as it has been demonstrated that the water gas, now so largely employed for lighting and heating, which is principally composed of carbon monoxide, is injurious and indeed becomes deadly when present in a quantity equal to one per cent of mixture. The custom of street dissemination of what might be called gas sewerage is proportionately as injurious to healthy living as though water sewerage was left to decompose in the city's gutters.

Carbon monoxide being odorless, it becomes doubly dangerous; for it not only suffocates mechanically, but acts directly as a true poison to the human system. Collections of mixed gases take place to such an extent that manhole explosions are not of infrequent occurrence, and the several companies occupying tunnel space in the streets are forced to secure conduit covers against gas pressure by bolting.

The plan to be submitted for the carrying off of contaminated ground air consists of a system of flues connected at sufficient intervals with sub-cellar and tunnel chamber compartments. When practical, chimneys constructed of metal piping or of brick may be built in connection with buildings. In districts where this is impossible they may take the form of ornamental columns. According to the observations of Dr. Draper, Director of the New York State Weather Bureau, the average yearly wind velocity over New York city is seven miles an hour. This speed being apparent at a mean height of seventy feet above ground level, it becomes thus entirely practical to employ the means which have been suggested for the removal of an insidious present and growing evil.

THE STEAM TURBINE FROM THE COMMERCIAL STANDPOINT.

In judging any new form of mechanical construction, it is the commercial considerations which, after all is said and done, decide whether it is to enjoy a temporary popularity, or be included among the useful and lasting improvements of its day. During the past four or five years the steam turbine has received more attention than perhaps any other device in the world of steam engineering; unless it be the water-tube boiler that can claim that distinction. It is not the fault of technical literature in general that the public is not pretty well familiar with the good points of the steam turbine; its compact form, great power in proportion to its weight, its general handiness, and its economy of operation. The many advantages of the turbine would lend one to expect that, commercially considered, it is a device upon which the capitalist would be sure to look with favor, as being from every point of view of installation, maintenance and operation, a decided "money-saver." This commercial aspect of the subject has been treated at considerable length in a paper read at the Detroit Convention of the American Street Railway Association, by Edward H. Sniffin, whose intimate connection with the development of the steam turbine in this country entitles him to speak with authority.

It has been found by actual tests on units as small as 400 kilowatts that only 14.47 pounds of steam was consumed per brake horse power per hour, which corresponds to something less than 13¾ pounds per indicated horse power per hour. In the larger units the turbine shows a uniform efficiency as compared with the best reciprocating engine practice; and only recently a rate of steam consumption corresponding to about 10.17 pounds per indicated horse power was guaranteed on a turbine of 750 kilowatts capacity. This is a performance of which only a very few engines of any size or type have been capable.

The question of the commercial value of the turbine, however, is a far wider and deeper one than that of mere steam consumption, for it must take note of the relative size of power-house required, the relative area and depth of foundations, and everything affecting the first cost of the plant itself. Into these elements of cost, the paper enters in full details. The paper, which is too lengthy for these columns, is published in the current issue of the SUPPLEMENT. It may be stated here, however, in brief, that the turbine requires about 80 per cent as much space as is necessary for a vertical engine of the same power and only 40 per cent of that needed for the horizontal engine. The most striking comparison in favor of the turbine is that which shows the cubic yards of foundation material required for the two types. In all three cases the foundations were estimated at a uniform depth of 15 feet, this depth being necessary to provide space beneath the engine room floor for condensers, etc., although for large reciprocating engines it is usually inadequate. The turbine has the great advantage that the only foundation which it requires is that necessary to carry its weight, as though it were simply a tank or some other stationary structure. It does not even call for foundation bolts, since there are no vertical or horizontal thrusts to be resisted. In a comparison of 1,000-kilowatt units, it was found that the volume of masonry foundation required for the turbine would be only one-ninth as great as for the vertical engine and one-fifteenth as great as that necessary for the horizontal engine. In a comparison of the building cost on a basis of fifteen cents per cubic foot of space inside the walls, the cost for the turbine is about one-half that for the horizontal or vertical engine. Among several actual cases given in the paper to show the saving in cost, we select that of a plant which was recently laid out to contain three 1,000-kilowatt units driven by vertical Corliss engines. Subsequent to the completion of the power house three more 1,000-kilowatt units were contracted for, steam turbines being ordered; and it was found that the use of the turbines saved 900 square feet of engine room floor space and about 38,000 cubic feet of space. Had the whole plant been originally designed for turbines, the cost of the land, building, foundations, etc., would have been reduced about $50,000. Perhaps the most striking proof of the economy of the installation of a turbine plant is that of a power house of 8,100 kilowatts capacity designed for the employment of vertical engines. In a consideration of the enlargement of the plant, it was found that there was no space for additional engine power, and that any increase would require encroachment upon valuable land. An estimate of what could be done by the employment of turbines proved that within the four present building walls, and without disturbing existing machinery, the total power of the plant might be doubled, by installing turbines in the space below the engine room level and by adding another floor of boilers—an arrangement which would reduce the interest charge over $3.00 per kilowatt per annum.

At the close of the paper the author stated that the 1,500-kilowatt turbine which has been for eighteen months in operation at Hartford, carries a load of from 1,800 to 2,000 kilowatts and has, indeed, carried a load, without any difficulty, of as high as 2,800 kilowatts. The Westinghouse Air Brake Company has four 400-kilowatt machines that have been running satisfactorily for about three years and doing all the work of the factory. The economy is high and there have been practically no repairs. The same company is now building three 4,000-kilowatt turbines for the rapid transit subway of New York, while four 5,000-kilowatt turbines are to be built for the Metropolitan District Road and three 3,500-kilowatt machines for the Metropolitan Road, both of London.

THE TWENTY-FIVE KNOT CUNARD STEAMSHIPS.

The contest for the high-speed transatlantic record has never seen a more interesting phase than that which it is now passing through. With the "Deutschland" carrying a record to her credit of 23.51 knots an hour; with the "Kronprinz Wilhelm" only a fraction behind the "Deutschland" in her average sea speed, and showing with each season a steady improvement; with the great "Kaiser Wilhelm II." launched and well on toward completion, and giving promise of 24 knots an hour and over, and with the plans for the two Cunard giants, designed to restore British prestige on the Atlantic, under consideration by various competing ship-building firms—it must be admitted that there never was a period in the history of high-speed transatlantic navigation more full of interest and promise than the present.

It is not likely that even the officials of the Cunard Company know what the exact dimensions, horse power and speed of the two new vessels will be; but we are reliably informed that, tentatively, the general features of the ships have been placed at 750 feet of length, 75 feet of beam, and a horse power of about 50,000.

Unless the directors change their minds, it is likely that the steam turbine will not be introduced on these vessels, for it is felt that notwithstanding the excellent performance of this type of motor on the "King Edward VII." and the "Queen Alexandra," it is too great a step from an installation of turbines of a few thousand horse power on a river steamer to the equipment of two costly vessels, on which so much is depending as on the new Cunarders, with what is as yet a comparatively new type of motor. Hence, it is probable that the great horse power of these ships will be developed in vertical, quadruple-expansion reciprocating engines; and the question which is now under consideration is whether this power shall be developed upon two or upon three shafts. If twin screws are used the proportions of propellers, shafting and engines would be enormous, since they would have to develop and carry probably not less than 25,000 to 27,000 horse power each. There is absolutely no precedent for such sizes and weights, the largest twin engines at present being those of the "Deutschland," which, when the boilers have been steaming freely, have developed as high as 38,000 horse power, or 19,000 on each shaft. The new "Kaiser Wilhelm II.," it is true, is to have engines of 40,000 horse power, or 20,000 upon each shaft, and in actual service they are likely to develop as much as 44,000, or say 22,000 on a single shaft.

It is natural that the Cunard Company in its endeavor to keep down the sizes of the separate engines should turn to the triple-screw system of propulsion. By so doing each shaft would have to carry only 17,000 or 18,000 horse power, or less than is now carried in the case of the "Deutschland." The objection to triple-screws is the very obvious one that the engine room staff would have to be greater for three engines than for two. But with this exception, it may be said that practically every other argument is favorable to the use of triple-screws. In the first place, judged from the all-important standpoint of safety of travel, there is less risk of total disablement in a triple than in a twin-screw ship. If one engine should be disabled only 33 per cent of the power is lost, and the ship still has 66 per cent with which to make port. The individual parts of the engine are much lighter, and hence it is easier to overhaul the engine in port, or, in the case of a breakdown, to make repairs at sea. Although it might seem at first that more of the ship's space will be taken up by three engine rooms than by two, the difference is not so great as might be supposed, inasmuch as the center engine would be located on the center line of the ship, astern of the wing propeller engines, and would occupy space in the least desirable portion of the ship from the standpoint of passenger accommodation. Admiral Melville, Chief of the Bureau of Steam Engineering of our Navy, is a strong advocate of the use of triple-screws, not merely for the Navy, but for the large transatlantic steamships. Speaking on the important question of economy he has shown that in the case of the fast commerce destroyers "Minneapolis" and "Columbia," which are fitted with triple-screws, there was a very decided economy realized by their use. Moreover, it is a significant fact that the French naval architects, who are among the best, if not the best in the world, and who are considered to have gone more deeply and thoroughly into the question of triple-screw propulsion than any other naval architects, appear to have adopted the triple-screw exclusively for all the large ships of the navy. They claim that, quite apart from their obvious military advantages, triple-screws show a very decided economy over twin screws. There is one other question which

should be carefully considered in adopting twin-screw propulsion for transatlantic passenger ships, and that is the question of vibration, which has so much to do with the comfort of passengers. It is a well-known fact that in the largest high-speed passenger vessels, vibration is one of the most serious sources of discomfort. The effect of triple-screw propulsion in respect to vibration is a question which should receive a most thorough investigation. While speaking of vibration, one cannot but call to mind that the steam turbine, because of the absence of reciprocating parts, that is to say, of more or less unbalanced parts, is the ideal motor for passenger service. There is no question that the first transatlantic steamship that is fitted with a successful steam turbine will have a great advantage in this respect over high-powered boats driven by reciprocating engines. Broadly considered, it must be admitted that the success which has attended the installation of turbine units of great horse power in electrical plants foreshadows the day when the steam turbine will be exclusively used in transatlantic travel. We cannot but think that the Cunard Company should give a most exhaustive study of the existing high-powered turbine plants before they decide that there is any inherent quality of the turbine which renders it unsuitable for use in tandem on the shaft of a transatlantic liner. Already turbines of 7,000 horse power are under contract for electric railway plants. If they can be built in 7,000 horse power they can surely be built successfully in 9,000 horse power units, and two such turbines on each of the three shafts of the Cunard boats would give the desired maximum horse power and something over. In an accompanying editorial and in the current SUPPLEMENT will be found most powerful arguments on the score of economy of cost, weight and space, in favor of the steam turbine, and every one of these arguments applies with just as much force to the engine room of a transatlantic liner as it does to the power station of an electric railway company.

THE HEAVENS IN NOVEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

The constellations whose outlines are associated with winter begin to appear again in the eastern sky. At 9 o'clock in the evening, during the middle of the month, Cassiopeia is almost overhead, directly above the Pole star. It can be recognized as a zigzag line of fairly bright stars.

The next group to the eastward, along the Milky Way, is Perseus. The remarkable variable star Algol is the southernmost of its two conspicuous stars, and lies between Cassiopeia and the Pleiades, somewhat nearer the latter group. For most of the time this star is of nearly the second magnitude, but at intervals of about three days—2 days 20 hours 49 minutes, to be more exact—it runs down to the fourth magnitude, remaining at this brightness for about 20 minutes, while the rise and fall in brightness occupy about four hours each. Minima observable in the United States occur on November 2, 8 P. M.; November 20, 1 A. M.; 22, 9 P. M.; and 25, 6 P. M., Eastern standard time.

The variability of this star is believed to be due to the presence of a dark companion, which partially eclipses it at every revolution.

Below Perseus is Auriga, marked by an irregular pentagon of stars, one of which, Capella, is the brightest one at present visible anywhere in the sky. Below this again is Gemini, whose twin stars Castor and Pollux are just rising. To the right of Auriga is Taurus. The group of the Pleiades, with the ruddy Aldebaran lower down, make this an easy constellation to identify. The little V-shaped group of which Aldebaran is one, is called the Hyades. The next star to Aldebaran is an interesting wide double, just separable with the naked eye.

Below Taurus is the incomparable Orion, the most brilliant constellation in all the heavens. With the two bright stars in his shoulder and knee, and the line of his belt between, he is so familiar that he hardly needs description.

To the left of Perseus, and southeast of the zenith, is the little triangle that marks the head of Aries. The faintest of the three stars is a very pretty double, requiring a small telescope to bring it out, which has an added interest from the fact that it was the first double star noticed by astronomers. It was discovered by Hooke in 1664. The large but inconspicuous constellations Eridanus, Cetus and Pisces fill the southeastern sky.

The great square of Pegasus lies to the southwest of the zenith. A line of conspicuous stars extending from it toward Perseus marks the position of Andromeda. The nearest of these to Perseus—Gamma Andromedæ—is a very pretty double star, the larger component being reddish, while the smaller is green.

The conspicuous star low in the southwest is Fomalhaut, in the constellation Pisces Austrinus. Aquarius lies above it, and Capricornus to the right. The fine cross of Cygnus, almost in the center of the Milky Way, is one of the most prominent of the western constellations. The star at the foot of the cross is another fine double which can be divided by a powerful field glass, while its contrasted colors show finely in a small telescope.

Lyra lies below Cygnus on the right, and Aquila on the left, each marked by a bright star.

The Great Dipper is close to the northern horizon, and the Little Dipper swings to the left from the Pole star, encircled by the coils of the Dragon.

THE PLANETS.

Mercury is morning star in Virgo, and should be visible in the southeast before sunrise, in the early part of the month. On the 3d he is at his greatest elongation. He is nearer the sun than usual—19 deg.—but in compensation for this he is unusually bright.

Venus is morning star until the 28th, when she passes through superior conjunction, and becomes an evening star once more. It is interesting to note that on this occasion she actually passes behind the sun, being hidden by his disk for nearly 24 hours. The phenomenon is of course unobservable, as the planet is lost in atmospheric glare long before she gets near the sun's limb. All through the month she is too near the sun to be seen without a telescope.

Mars is morning star in Leo, rising about 1 A. M. on the 15th. He is nearly on the line joining Regulus and Spica, about one-third of the way from the former toward the latter, and is fairly bright.

Jupiter is evening star in Capricornus, remaining visible till about 10 o'clock. On the 1st he is in quadrature, and is due south at 6 o'clock.

Saturn is evening star in Sagittarius, and sets between 8 and 9. Uranus is in Ophiuchus, too near the sun to be visible, and Neptune is in Gemini, coming to the meridian at about 3 A. M.

THE MOON.

First quarter occurs at 7 A. M. on the 8th, full moon at noon on the 15th, last quarter at 3 A. M. on the 22d, and new moon at 9 P. M. on the 29th. The moon is nearest on the 16th, and farthest off on the 4th. She is in conjunction with Uranus on the 3d, Saturn on the 6th, Jupiter on the 7th, Neptune on the 18th, Mars on the 23d, Mercury and Venus on the 29th, and Uranus again on the 30th.

The Leonid meteors are due on or about the 13th of November, but there is no reason to anticipate any unusual display this year. The great body of meteors, deflected in its orbit by planetary attraction, has long since passed by the earth without meeting it, and whatever stragglers may appear this year will be so much obscured by the moonlight that only the brightest of them can be seen.

TEST OF A NORWEGIAN LIFE-SAVING BOAT.

On the afternoon of October 22, a hazardous demonstration of the efficiency of a Norwegian life-saving vessel took place in the English Channel. A tug boat, when four miles off Folkestone sighted a strange-looking object in the water. Steaming up, the captain found that the object was a large globe, from a manhole in the top of which a man's head projected. As the tugboat came alongside, two men crept out of the globe, who proved to be Captain Doenvig, the inventor of the device, and his assistant. They told a weird story of their adventures. It seems that their globe was dropped overboard from a steamer off Havre on the 21st, and that since then it had been knocking about in the Channel with its two occupants. In their confined quarters they had been penned for more than twenty-four hours before they had been picked up. Naturally the inventor considered his experience the most satisfactory proof of the efficiency of his device.

The apparatus, or buoy, is round as a globe, only a little flattened at the bottom. It is made from solid sheet iron of the following thicknesses: At the bottom five-sixteenths of an inch, on the sides three-sixteenths of an inch, and at the top one-eighth of an inch. The diameter of the buoy is 8 feet; the height 6½ feet. The buoy has a double bottom and draws 2½ feet of water when loaded. The inside of the buoy is entered through three water-tight trapdoors.

Under the deck, which is located about 1 foot below the water line, are placed 4 galvanized tanks, with capacity for holding about 140 gallons of fresh water. Alongside the wall runs a low bench to sit on, and the space underneath it is to be filled with canned goods. In the center of the inner room is a funnel that can be shoved up, thus letting fresh air into the buoy. In the top are three small windows, partly for the purpose of letting in light, but also for use in sending up rockets. The buoy is provided with a movable keel which can be let down from the inside; also with a rudder which can be applied in the same manner. Assisted by small oars, which are kept inside, the buoy can be propelled to land in fair weather. On the outside of the buoy is a cork belt, on which the men may stand and row. Further, the buoy is supplied with an anchor and 100 feet of steel rope and with sails, the air funnel serving as mast.

Some years ago the inventor, Captain Doenvig, was in a shipwreck on the coast of Virginia, which bereft him of his family, and ever since he has been deeply interested in the construction of a lifeboat which may be serviceable under all circumstances.

SCIENCE NOTES

It will be remembered that some time ago Dr. Garnault attempted to disprove Dr. Koch's theory of the transmission of tuberculosis to human beings by animals by inoculating himself with bacilli from a consumptive cow. Dr. Garnault himself is perfectly well, but guinea pigs inoculated with skin taken from his arm have developed symptoms of tuberculosis.

Prof. Edmond S. Meany, of the Smithsonian Institution, is the first scientist to visit the mummy caves of the Aleuts of Alaska. Many mummies, to be sure, have been sent from Alaska from time to time, but no man of learning has ever examined the caves themselves. The report which the professor will doubtless prepare will be looked for with some interest.

At Grove City, near Chillicothe, a perfect skeleton of the Mastodon Americanus was found. The tusks measure from 10 to 12 feet in length. Their size and the condition of the teeth, which are well worn, show that the animal was full grown when it died. Other well-preserved specimens have been found in marshy beds in Ohio; but this is said to have been found in clay, a rather unusual circumstance.

The Scotch mineral known as Lanarkshire blackband, which was discovered in 1801, has been practically exhausted, as there are now no pits in the Lanarkshire coalfield where it is worked as a principal product, though a small quantity of a thin blackband is raised with the gas coal at one or two pits. Some blackband of excellent quality is, however, still raised in Fife and Midlothian for smelting in the Lanarkshire furnaces, while the somewhat leaner blackbands of Ayrshire are still fairly plentiful.

The report which Booker T. Washington sends to us of the Tuskegee Normal and Industrial Institute shows a state of affairs that is encouraging. Up to the present time there have grown out of the Tuskegee Institute at least seventy-two schools of considerable size. Perhaps the most important work that Tuskegee Institute, in connection with schools of similar character, has accomplished has been to find the most effective way to elevate the negro and at the same time to make him most useful to the community in which he is to live. In the history of the institution nothing is more striking than the change which has taken place among the negroes so far as their feeling toward industrial education is concerned. Formerly industrial training was by no means looked upon with favor. Now that feeling has completely disappeared. At present students are trained at Tuskegee in thirty-four industries.

In 1851 Foucault originally demonstrated the rotary movement of the earth by means of the pendulum which bears his name. The experiments were interrupted after the *coup d'état* of December 2, 1951. Another demonstration was carried out on October 22 last. Foucault's pendulum, composed of piano wire, about 220 feet long, was attached to the summit of the dome of the Pantheon and from it was suspended a ball weighing 56 pounds. The steel stylus was fixed to the bob thus constituted, and beneath it on the floor was placed a round table upon which the points of the compass were marked. A little heap of sand was run around the table. Flammarion, the well-known astronomer, and Senator Chaumie, Minister of Public Instruction, delivered appropriate speeches in the presence of a large assembly, which included numerous scientists. Then the minister, with a taper, burned a silk cord attaching the pendulum to the side of the table, and the pendulum swung across the table, cutting a trench through the sand, each swing widening the trench slightly until the table appeared to be revolving.

A curious fact has been ascertained during the recent survey of India—namely, that the northerly deflection of the plumb-line, ascribed to attraction by the great mass of the Himalaya and the Tibetan upland, is reversed along a comparatively narrow belt between 22 deg. and 24 deg. north latitude, crossing India from east to west for one thousand miles. Here the deflection is southerly, while the northerly deflection reasserts itself farther south, and is continued so far as 18 deg. north latitude. The zone, so strangely exempted from what has been supposed to be a general law, runs across Central India from the delta of the Ganges to that of the Indus, but well to the south of the great Gangetic plain. These facts are discussed by Major Burrow in a paper read before the Royal Astronomical Society. Major Burrow's theory is that the phenomenon follows the axis of what he calls a subterranean chain of mountains, causing the greater density of the earth's crust in this particular tract. The hypothetical range would, we are at liberty to conjecture, either have foundered bodily in some great catastrophe or subsided gradually and been submerged under alluvium and silt. The fact opens up an interesting subject for the discussion of geologists.

THE "PREUSSEN," THE WORLD'S LARGEST SAILING VESSEL.

A few weeks ago the "Preussen" started on her first voyage to the west coast of South America. She is probably the largest sailing vessel in the world. Her length is 440 feet; beam, 50 feet; draft, 33 feet. She has a carrying capacity of 8,000 tons, while her registered tonnage is 4,000.

The "Preussen" was built in the shipbuilding yard

THE "PREUSSEN," THE WORLD'S LARGEST SAILING VESSEL.

of Geestemuende, famous the world over for its fast sailing vessels. She is a five-masted, full-rigged steel vessel, steel-sparred throughout. Five hundred and fifty tons of water ballast are carried in her double bottom. As in most large, modern sailing vessels, steam power is used to drive the winches, capstans, pumps and steering gear. As a result her crew consists of only forty-six hands.

A HUGE METEORITE RECENTLY DISCOVERED.

Prof. Henry A. Ward, of Rochester, N. Y., the veteran meteorite hunter, recently found a meteorite of tremendous size. It has a length of thirteen feet and one inch; width, six feet and two inches; thickness, five feet and four inches, and weight, fifty tons. Prof. Ward has named it Bacubirito, after the mining town near which it was unearthed, and which is situated on the Rio Sinaloa, Mexico. It took twenty-eight able-bodied peons one entire day to uncover its upper surface, making an excavation thirty feet on a side, with the great meteorite lying within. At the end of the second day they were able to bring the huge mass to a semi-vertical position, the Mexicans standing aghast at the revelation of their work.

The Bacubirito was found on a farm called Ranchito, which fills the narrow mountain valley between two spurs of the foothills, running nearly north and south, and 2,000 feet above the level of the sea. It lay in a cornfield, close by the eastern edge of the valley, which is covered by a black vegetable soil two yards in thickness. The giant meteorite lay imbedded in the soil with one end slightly projecting above the level. Professor Ward walked for many feet along and across its surface, surveying the dimensions as far as they were exposed, but he had no idea how far the large and heavy mass penetrated the soil beneath until the work of excavation was begun.

The characteristic pittings covering the entire surface are well marked, and very regular in size—about two or three inches across, with well defined yet low walls. The bed in which the tremendous rock lay was found to be a clean depression crushed into the rock with absolutely no trace of soil between it and the part where the full weight of the mass had fallen, showing that the meteorite had fallen on the bare surface of this district at a period before the vegetable soil had begun to form here, carrying back the fall of Bacubirito to a remotely distant period.

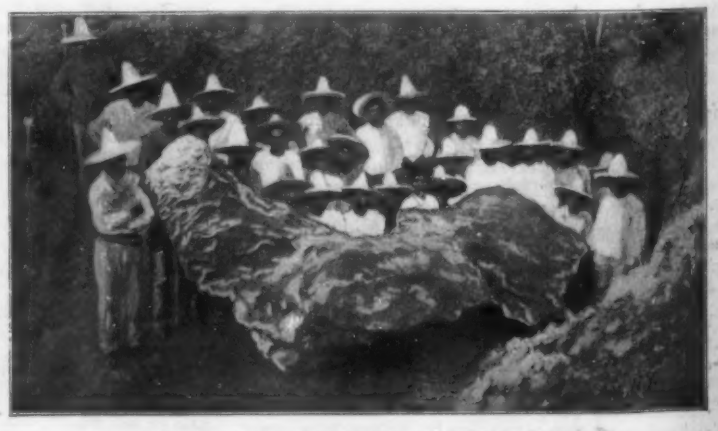
For half a century Professor Ward has been collecting and studying meteorites. He has interested himself in them in every part of the globe where they have been found. As the result of his personal exertions he has installed at the American Museum of Natural History, New York, the Ward-Coonley collection of meteorites, allowing this collection which represents an amount of labor, research, indefatigable industry and painstaking ingenuity of which the average visitor is entirely ignorant, to be placed in the halls of this museum for inspection and study. The collection represents five hundred and eleven distinct "falls," about five-sixths of all the meteorites known to science. To see these elsewhere would require a visit to the great museums of the world, and many cabinets of private collectors. Bacubirito, however, is possessed of qualities which render it of greater scientific value than any of Professor Ward's other meteorites. The inner structure shows the octahedral system of crystallization in a very marked degree. No other meteoric iron is known which shows this so well. Fractured surfaces show crystallization plates with faces from three to nineteen millimeters in greatest diameter. Many of these faces are covered with fine films of taenite, which in most cases are of the characteristic bronze yellow color. Acid brings out the Widmanstattian figures in a most beautiful manner. From the coarse crystals on a fractured or weathered face of this iron, we might anticipate that etching would reveal a large wide pattern in its markings.

As a fact, quite the reverse is true. The figures, while very sharp and clear, are small in pattern, and are composed of narrow blades of kamacite, but a fraction of a millimeter in thickness. At intervals, these blades appear to be of more than double that thickness; but when examined with a glass it is seen that these apparently broader plates are composed of what might be termed "bundles" of narrow kamacite bands. The rhombic figures on the etched face will average from one and a half to five millimeters in diameter, two angles of same being sixty degrees and one hundred and twenty degrees, while the triangular markings will generally range from eight to fifteen millimeters with angles of fifty-five degrees and seventy degrees. Two or three troilites are shown, and the iron is essentially tough.

The specific gravity of Bacubirito is 7.69. Its analysis has been made by Professor J. E. Whitefield, of Philadelphia, as follows: Iron, 88.944 per cent; nickel, 6.979 per cent; cobalt, 0.211 per cent; sulphur, 0.005 per cent; phosphorus, 0.154 per cent; silicon, trace.

After a long, protracted effort, Professor Ward succeeded in detaching from the mass an already partly loosened piece of about eleven pounds in weight. This, polished and etched on one side, showing the beautiful Widmanstattian figures, has taken its place in the Ward-Coonley collection of meteorites. This collection is now on display (on deposit) in the American Museum of Natural History in New York city.

END VIEW OF THE METEORITE.



BACUBIRITO, A HUGE METEORITE RECENTLY DISCOVERED.

AN ANCIENT FIRE ENGINE.

There has recently come to light at Stowmarket an interesting relic of the past in the shape of the old town fire engine, which did duty in the town for many years in the early part of the eighteenth century. The engine, which is in an excellent state of preservation, is composed of a wooden well 6 feet long by 15 inches wide, lined with copper, with openings at each end for the purpose of receiving the water, which was fed by hand. The pump is at one end, and is worked by ordinary hand-bars. The engine is mounted on four small solid wooden wheels; the leathern buckets with which it was originally fitted have all disappeared, but the delivery-pipe, which is some 6 feet long, can still be attached. The engine is painted the regulation red color, and on the front of the pump are printed instructions for its proper working. To keep the pump in order it is suggested that "the pevets of the long iron spendil" should be "drest with sallet oyl and tallow," while the hose after use is to be "liquored with neatsfoot oyl, bees wax, and tallow,

STOWMARKET'S ANCIENT FIRE ENGINE.

and quolied up." These instructions were originally covered with horn, but of this only a small portion now remains.—Engineering Times.

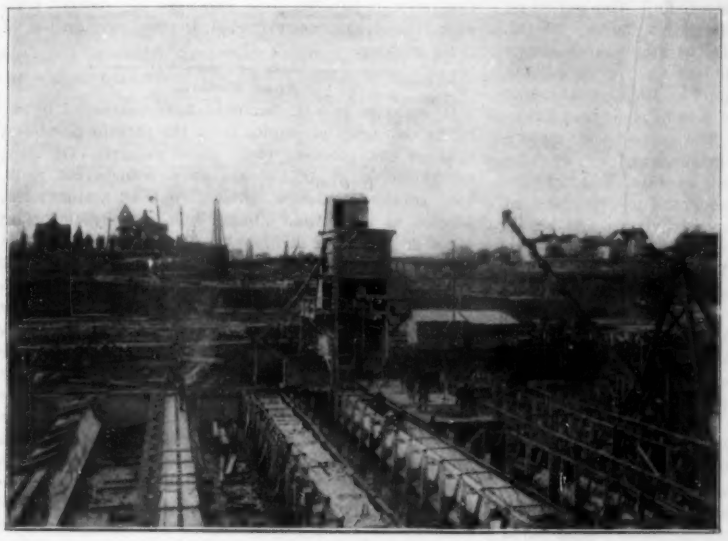
Novel Method of Killing Hawks.

A farmer who lives in northern Louisiana has grown weary of peppering gray hawks with blue whistler buckshot. It takes too much time. He sat down and thought long, and finally evolved a method that does credit to Yankee ingenuity. Every one knows that hawks perch only on dead trees. This Louisiana farmer made a strong pole some 50 feet in length by nailing some scantlings together. To one end of the pole he tied a scythe blade, with its razor edge turned down. He set the pole up about 500 feet from his barnyard. An hour had hardly passed when a black hawk alighted on the scythe, grasped it with its talons, but released its hold with a suddenness that gave ample proof of an injury sustained. The bird glanced down and attacked the scythe viciously. It was cut again and again, but never relented, maddened probably by its own blood, as most hawks are. After a short struggle the bird fell to the ground with its head split open. This Louisiana farmer has killed many hawks in the same manner.

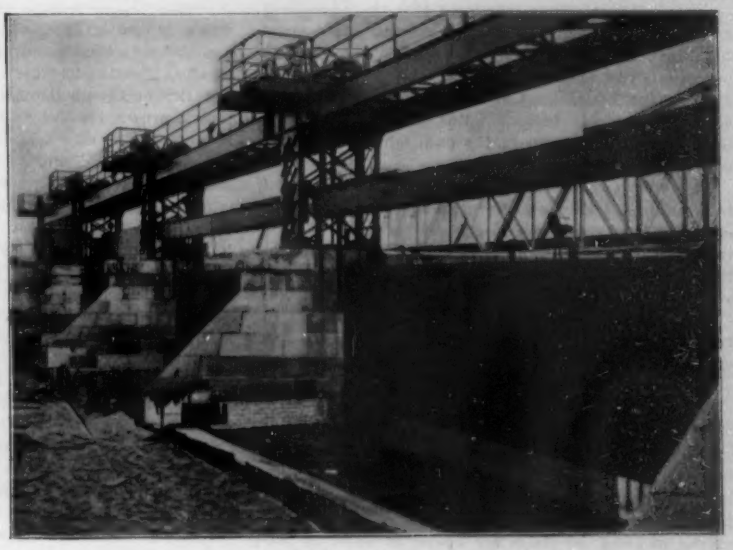
THE SAULT STE. MARIE WATER POWER CANAL.

The opening of the Michigan Lake Superior Power Company's powe canal at Sault Ste. Marie again attracts attention to an undertaking which is entitled to rank as one of the greatest hydraulic developments ever carried out in the United States. The cities of Sault Ste. Marie, Michigan, and Sault Ste Marie, Ontario, are situated on either side of St. Mary's River, which connects Lakes Huron and Superior and serves to carry the greatest part of the commerce of the Great Lakes. At a point opposite the cities there is a great fall in the level of the river and to avoid the rapids the United States and Canadian governments have expended $1,000,000 in the construction of canal locks. The growth of Sault Ste. Marie and the admirable opportunity afforded by the topography and hydraulic conditions of the neighborhood, rendered it only a question of time when some hydraulic-electric scheme would be inaugurated for utilizing the hydraulic energy of the rapids. The theoretical hydraulic energy to be developed by the canal recently opened will amount to some 60,000 horse power. The power house itself, which will be located on the St. Mary's River front, is about 1,400 feet in length, 100 feet in width and rises to a height of 75 feet above the water level. Within the building are eighty-one turbine chambers, each 16½ feet in width and containing four 33-inch turbines installed in tandem. All four are carried on one shaft, at one end of which, outside the turbine chambers, is coupled an electric generator of 400 kilowatts capacity. One of the turbine chambers will not contain any turbines, but will be utilized as a spillway for the discharge of ice and debris.

The essential parts of the building are the foundation, the sub-structure or pit, the superstructure, including penstocks and dynamo floor, the mill floor and the roof. The foundation contains 12,000 50-foot piles. In the sub-structure are eighty-one pit walls, each 100 feet in length, 3 feet thick and 20 feet high, closed at the up-stream end by arched forebay walls. Each chamber has an invert concrete floor and a concrete roof. The sub-structure is thus made up of eighty-one concrete tunnels each 100 feet long, 15 feet wide and 20 feet high. Above these is the superstructure, consisting of eighty-one penstock partitions each 20 feet high, 45 feet long and 15 feet wide. The down-stream end, between each two partitions, is closed by semi-circular, steel-plate bulkheads. Inside each of these partitions is installed a set of four 33-inch turbines, each turbine being arranged with its axis parallel to the center longitudinal line of the penstock. The turbine shaft passes through the semi-circular steel bulkhead wall and into the dynamo room where it is direct-connected to its dynamo. The water flows from the forebay into the penstocks, through the turbines, down into the pit tailrace and out into the lower St. Mary's River. The number of turbine wheels when



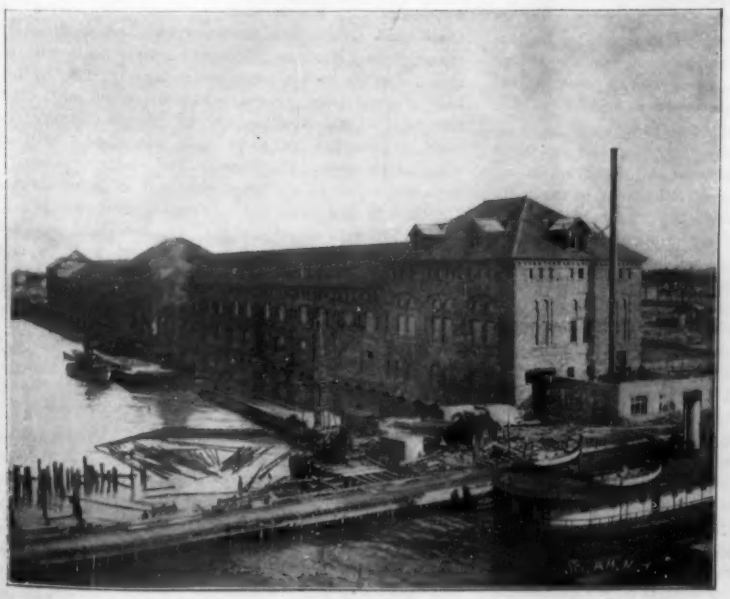
Foundations of the Wheel Pits Below Power House.



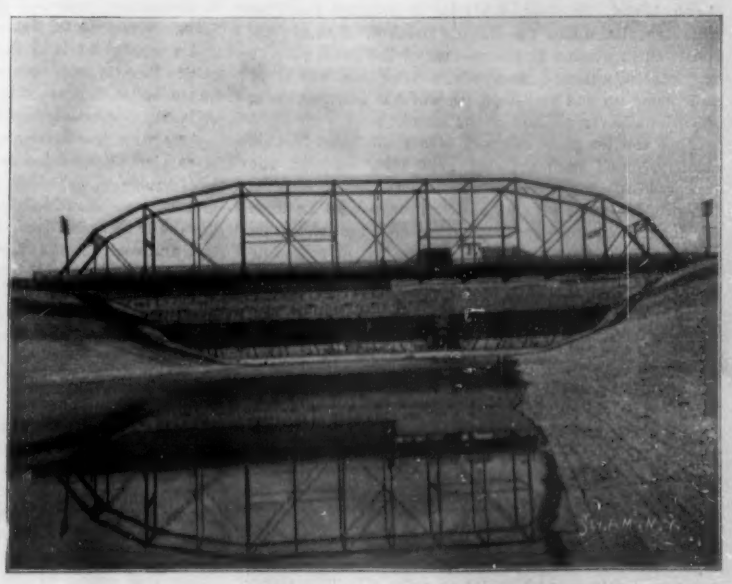
Regulating Gates at Head of Canal.

Railroad Bridge Across the Canal.

A Stretch of the Canal, Showing Highway Bridge in the Distance.



The Great Power House, 1,400 Feet in Length.



A Highway Bridge Across the Canal.

THE SAULT STE. MARIE 60,000 HORSE POWER CANAL AND POWER HOUSE.

the complete plant is installed will be 320. These will drive no less than eighty dynamos.

The intake to the power canal lies just south of the western entrance of the United States ship canal. Its width is some 950 feet, its southern alignment running nearly east and west from its intersection with the established harbor line on a tangent for about 2,900 feet. It varies from 950 feet at the intake to a width of 250 feet about a fifth of a mile from the point where the waters of Lake Superior enter. It continues at this width to the eastern end of the intake. Here, at the commencement of the canal proper, the flow is controlled by a set of head gates, consisting of four massive steel shutters, each 48 feet wide by 26 feet high, moving vertically between heavy masonry piers. The total length of the canal from this point to the forebay is nearly 2 miles. At the various sections of the canal, the section of flow area differs, being 4,800 in the intake, about 4,300 square feet where it runs through sand and about 4,600 square feet where the channel is cut through rock. It is calculated that the water will flow through the entire length at a depth of about 23 feet when the plant is in operation. The estimated velocity of the water under these conditions is about 4½ miles per hour. This would deliver to the turbines about 30,000 cubic feet of water per second, which would supply an output in the power house of about 60,000 horse power.

The forebay is formed by the expansion of the canal to a width of 1,400 feet. Here the slopes of the bank and the general construction are similar to that of the canal proper. Near the power house is constructed an intercepting rack for catching drift and ice and preventing their entrance to the penstock.

In the construction of the canal it was necessary to construct several steel foot and vehicle bridges, some of which are shown in the accompanying illustrations.

MANUFACTURE OF TIN PLATE.—II.

In our issue of October 4, 1902, we described and illustrated the first part of the process of tin plate making, including the rolling of the black plate from the steel bars, and its pickling, cold rolling, and annealing. It was shown that after the second annealing and second pickling the plates are placed in water to protect them from the action of the atmosphere, and to prevent re-oxidation, and are carried in troughs running on tramways to the tinning departments, of which there are two at the Laughlin plant. One of these departments consists of a tin house and assorting room which cover about sixty-two thousand square feet, devoted mainly to the production of canners' tin (generally designated as "coke" plates). In the coke tin house building are thirty-two tinning stacks, arranged along both sides of the building, leaving a wide aisle in which the machinery for branning, cleaning, and dusting the plates is placed. The other tinning department is a T-shaped building covering about twenty-six thousand square feet with fourteen tinning stacks, which are devoted to the manufacture of high grade Terne plates (roofing tin). Both these departments are equipped with a complete system of tramways and turn tables, on which the tanks holding the immersed black plates can be readily transported to the several tinning stacks. The power for running the machinery in these departments is transmitted by shafts and belts from one central power plant.

Originally the method of tinning the plates was the simple expedient of dipping them in a bath of molten tin and allowing the surplus metal to drain off; but some thirty or forty years ago, a Mr. Morewood, of South Wales, England, designed a tinning machine which revolutionized the tinning process. The system consisted in placing at the surface of the pot a pair of very carefully turned steel rods, which seized the plate as it came up and rolled off the surplus tin, leaving a smooth and even coating of the metal.

Since the tin plate industry was established in this country, many improvements have been made in the process of making "coke" tin which have not only made the product more serviceable, but have also reduced the manufacturing expenses. The most essential part of the present improved system is the use of rolls submerged inside of the tinning pots in the hot metal and oil baths. Through these rolls the plates pass while the coating process is going on, thereby securing a perfectly uniform coating and highly polished surface.

In the manufacture of high grade roofing tin the old style or hand-dipping process is still practised to a large extent at the Laughlin Works; it has been found that a heavy coating of the tin and lead alloy is essential to the lasting quality of roofing plate, and experience has proved that this heavy coating amalgamates more thoroughly with the iron black plates in the slower hand-dipping process.

In this hand-dipping process, known as the "MF style," the plates pass through four or five different pots filled respectively with metal or palm oil. The plates made by this process resist attacks of the atmospheric air more thoroughly than plates made in the "coke" tinning process. Recently a new method of finishing the old style plates has been introduced at the Laughlin Works. In this new method the plates after coming out of the last old style or "MF" tinning bath, are immersed immediately in an oily substance, the temperature of which is below the melting point of the coating metal, and an instantaneous and uniform setting of the coating metal is thereby effected on all parts of the sheets alike.

While the best roofing plates are still made by the old English style, improved by American new methods, a number of economical devices have been introduced in the production of "coke" plates.

We present a sectional illustration through a modern tinning machine, which shows very clearly its construction. The heavy cast-iron tin pot is carried in a brick setting, and the tin is kept molten by a furnace below the pot. In the bottom of the pot is about fourteen inches of molten tin, and above this on the discharging side is twelve inches of palm oil. The black plate is introduced into the tin pot through the hopper, *A*. This hopper holds a chemical fluid, the weight of which is less in specific gravity than the molten tin, and which in combination with the tin and iron causes a galvanic action by which the iron and tin are quickly and thoroughly amalgamated. The tinner pushes the plate downward with a pair of tongs over curved guide-bars until it is seized by the first pair of rolls known as the "feed rolls," marked *B* in our drawing. By these it is drawn through the molten tin into the upwardly-curved hopper, *C*, in which are running two pairs of rolls, *D D*. The top pair is partly visible and partly immersed in the palm oil which covers the tin on this side of the machine. These rolls are held suspended in a housing frame, and are regulated by means of screw-adjusted springs, *E E*, and upon this adjustment depends the thickness of the coating of tin given to the plate. We present illustrations of two complete tin pots, in one of which the plates as they come out of the rolls are picked up by an automatic catcher, that is, a mechanical figure with arms and fingers, which stands above the finishing pot, taking the place of a man, seizing the plates as they rise through the rolls, swinging them sidewise, coming to a stop, automatically dropping the plate into a branner, coming back to its original position and repeating the operation in rapid succession.

The other illustration shows the "Bennett" device for transferring the plates from tinning pot to branner. This consists of a revolving drum with the points of contact with the plates magnetized by electrical connections.

As the plates leave the tin pot, they have upon them a thin coating of oil which has to be removed. For this purpose they are put into a branner which is located conveniently at the side of the tinning machine. The branner consists of an inclosed wood and metal box, through which a series of carriers, *C*, are continually traveling on an endless belt. The plate, *B*, as it comes from the tinning machine, is placed in a rack, *A*, which is so located that the plate will be caught up by the traveling racks, *C*, and by them carried through the machine. The interior of the branner is filled with bran and slaked lime, and as the carrier travels, it forces the plate through the bran and lime, which clean off the deposit of palm oil. After the plate has passed through, it drops into what is known as the "duster," where it is passed slowly through a rapidly revolving pair of sheepskin-covered rollers, which clean off the residue of the palm oil and impart a finishing polish to the plate. There are three of these sheepskin rollers, and by the time the plate has passed through the set, it shows the beautiful finish for which tin plate is noted. The automatic catchers, the branner, the duster, and a number of other devices are American inventions made since the industry was introduced in this country, and a large amount of tedious work of men, boys and girls has been substituted by these machines.

Assorting Room.—From the tin house the tin plate is carried on elevated trolleys to the assorting room, and deposited on tables where each sheet is carefully handled and examined for defects. The perfect plates are then "reckoned" or counted at the rate of 112 to the box, and each set of 112 is weighed before boxing.

There is no branch of the iron or steel trade which requires so much care or commands so much detail of handling as the manufacture of tin plate, and some of the highest wages paid for any industrial labor in the world are earned by the operators in the American Tin Plate Mills. The high cost of manufacture is due to the fact that each sheet has to be handled separately by from ten to twelve persons, and the quickest time of manufacture that has been made from the raw material in the shape of flat bars to the finished and boxed tin plate is ten days. At the present time, when labor counts for so much, it can be understood that the frequent handling of these light plates must result in a high cost of the finished product, and hence it is that the lowest grades of tin plate cost as much as $80 per ton. The greatest production is about 40 tons per week for one mill on the basis of a rate of 100 pounds weight per box.

In concluding our notice of this interesting work, we give some figures of the consumption, etc., which will prove of decided interest. In the Laughlin Works the amount of sheet bar steel consumed as raw material per week is 1,100 tons, a large total when we bear in mind the costly nature of the product. The total consumption in sheet bars per year is 50,000 tons; of coal, 55,000; of tin, 1,250 tons, and of palm oil, 250 tons; while the total output of the finished material is 1,000,000 boxes of tin plate per year. To produce this output requires the steady employment of 1,500 employes, and the paying out in wages annually of $1,000,000. It will be seen at once that the rate of wage paid at the tin plate mills is very high, reaching an average of $670 per year per employe. This is explained by the fact, as we have already stated, that the workers in some of the departments of the tin plate mills are the best paid in the world, the tin rollers who roll the black plate getting as high as from $7 to $10 per day. We are indebted to Mr. W. T. Graham, president of the American Tin Plate Company, and to Mr. C. A. Robinson, the district manager, for courtesies extended in the preparation of these articles.

Toad Poison.

C. Phisalix and G. Bertrand have succeeded in isolating two toxic principles from the parotid gland and skin of the common toad, *Bufo vulgaris*. Of these bufotaline, $C_{110}H_{171}O_{35}$, occurs as a transparent resin, very soluble in alcohol, chloroform, and acetone; less soluble in ether, and almost insoluble in petroleum ether or in carbon disulphide. It is precipitated from alcoholic solution on the addition of water, forming an emulsion, which is redissolved on further adding a large volume of water. Although very dilute, the solution thus obtained is extremely toxic to frogs. It acts on the heart, and does not affect the nervous system. Applied to the tongue, it has a bitter taste and gives rise to a peculiar and very persistent sensation. It is obtained by squeezing the parotid glands of the animals under water. The opalescent acid liquid thus resulting is filtered through a Chamberland filter and evaporated. During evaporation a less soluble portion separates as a white pellicle, which is removed as it forms. It is washed with water and redissolved in absolute alcohol or in chloroform, and purified by filtration. This is bufotaline. After its removal the residual extract is exhausted with alcohol; the alcohol is distilled off, and the residue, dissolved in water, is treated with basic lead acetate. The lead precipitate, decomposed by H_2S, liberates another toxic body, bufotenine, which is purified from adherent bufotaline by treatment with chloroform in which the former is insoluble, and by ether, which removes the acetic acid. Bufotenine exerts a powerful paralyzing action on the nervous centers. Faust has also isolated bufotaline, but since he worked upon the alcoholic extract of the dried skins of the animals, his product is considered by the authors to have been impure. They find that this extract contains a substance which has no relation to the toxic body. This is the body named bufonine by Faust, which does not occur in the pure secretion of the glands.

The Current Supplement.

The current SUPPLEMENT, No. 1400, opens with the first installment of a series of articles on the Berlin electric underground and elevated railway. Particular care has been taken to illustrate this series copiously. Rarely, indeed, have such handsome illustrations been presented of a great city tramway. The pictures show how admirably the German engineers have carried out their work, from both the electrical and architectural standpoints. Another important article deals with the steam turbine in its commercial aspect. The Ruthenberg electric iron process, which attracted such attention at the last meeting of the Electro-Chemical Society at Niagara Falls, is fully described. Still another industrial application of electricity is described in an account of electrical methods of glass-making. Dr. Otto N. Witt, the well-known German chemist, discusses recent developments in coloring matters. Among the minor articles of interest may be mentioned those on a core-wire straightening machine, the Sigriste photographic apparatus, and the life of the curious Chinese xiphopagous twins. Peary's work in 1901 and 1902 is discussed at length. The electrical conductivity of plant juices is a subject on which Mr. Fred. D. Heald writes exhaustively. The usual selected formulæ, trade notes and consular information will also be found in the current SUPPLEMENT.

Torpedo Boat Destroyer "Stewart" Makes a Record.

The torpedo boat destroyer "Stewart" has proved herself to be the fleetest craft in the United States Navy. She went through her trials without an accident. She was supposed, according to contract, to keep up a speed of 26 knots for one hour. She did this without any trouble, and exceeded it by 3 knots, the official figures given out being 29.3 knots.

Correspondence.

High Pressure from Calcium Carbide.

To the Editor of the SCIENTIFIC AMERICAN:

In making a series of experiments for an acetylene apparatus, I have been astounded at the terrific pressure I could obtain practically instantaneously with the calcium carbide. My apparatus was a four-foot piece of steel pipe tested to 600 pounds to the square inch. It is capped on the bottom. The top cap is drilled for a stuffing box with gland nuts; a turned steel shaft runs through the stuffing box, on the end of which a carbide basket is hung made of ordinary wire. The pipe is filled to about six or eight inches from the bottom with water. A release cock for the air, and a pipe for screwing on a steam gage are tapped in the stuffing box. The gage reads to 400 pounds. On lowering the shaft touching the carbide to the water and forcing the air out, a second quick plunge forces the gage around to 400 pounds in three seconds.

It may and should be that this instantaneous raising of high pressure can be applied to some mechanical and commercial use, such as pressing cotton, baling hay or even as an explosive. The idea is offered to those of your readers, who can make a mechanical and commercial use of it. GEO. HUSTON.

Sandon, B. C., October 14, 1902.

Do Mussels Move?

To the Editor of the SCIENTIFIC AMERICAN:

Some time ago I read an article on the pearl button trade of the Mississippi and Arkansas Rivers, and in it found the following paragraph: "Authorities differ upon the question of whether mussels move or not, except as the water makes them or they fasten onto some moving object that touches them, but the fact that sand and mud deposits kill them seems to establish their inability to move without assistance." I was reared on the Tennessee River, and lived for a number of years near the Colorado, in Texas, and have had ample opportunity to make observations on the characteristics of the mussel. I can state emphatically that mussels do move. I have watched them for an hour at a time. They elevate themselves with the open part of the shell down; a mussel six inches long and three and one-half or four inches wide will make in moving, two parallel lines about one and one-half inches wide. Their method of locomotion is to protrude sufficiently out of the shell and operate on the same principle as a snake, moving very slowly. If the water is disturbed in the slightest manner they will close their shell at once and fall over. I do not suppose they can hear, but of course they have sensation. The fact that mussels are covered up by sand deposits and destroyed is no argument against their locomotion. The mussel is a very slow mover, and the debris of a river moves rapidly during a rise, and of course the mussel is unable to reach a place of safety. In the West I have seen hundreds of fish drowned in the sudden rise of a stream caused by a waterspout. It is not strange, then, that the slow-moving mussel should be killed by the same cause. E. H. OLIVER.

Gary, Fla., October 6, 1902.

Smelting With Oil.

BY C. W. ARTHUR.

Under the auspices of the Oil Blast Furnace Company, a crude-oil-burning smelter recently erected in Los Angeles was given its first run on October 1.

The test was made on a quarter of a ton of copper ore that had been taken from a mine in San Bernardino County, Cal.

Several hundred pounds of iron slag were first run through the furnace for preliminary heating purposes, after which came the test, fully 60 pounds or about 13 per cent of pure metal being the result. The smelter is a very crude affair, with a capacity for ten tons per day, it being the intention to construct a first-class apparatus as soon as all necessary arrangements are perfected.

A Connersville blower, an improvement upon the old Root process, was employed upon the air blast by which the crude petroleum was sprayed in the furnace. It worked at the rate of three and one-half cubic feet per revolution, although its utility in that respect is somewhat regulated by the size of the furnace, and it is capable of operating at different speeds. Its power in the test was derived from a miniature engine which was designed by F. P. Pettingill (who also designed the smelter), which, while operated by gasoline, was built upon principles identical with those using steam.

The air becomes heated to a degree equivalent to 400 deg. Fahr. before reaching the furnace, thus obviating any objectionable features that might exist by reason of transmission of air in a cold state.

Much is claimed for the new process, especially upon the basis of cost. It is said that a saving of from one-fifth to one-quarter can be made upon the item of coke alone, and that ores of an exceedingly silicious character can be handled, provided a reasonable percentage of other rock is also treated.

Electrical Notes.

In studying the heating effects upon the poles of a spark-gap, as affected by the variance of the inductance of the circuit, Mr. B. Eginitis uses Tesla coils without a core, and poles of fine wire. The brightness of the aureole varies at first inversely as the heating effect for all metals examined. At high inductance, both the temperature and brightness increase with increasing inductance—at least, in iron and steel. A closer study of the effects by determining the temperatures of the poles was made with the aid of a thermoelectric couple. The metals examined include aluminium, copper and silver. The heating first increases rapidly with increasing inductances, and then breaks into a succession of maxima and minima. The presence of metallic vapor is not a primary factor in the heating effect, as is shown by the fact that at small inductances the brightness of the spectrum decreases with increasing inductances, whereas the heating increases very rapidly.

At a colliery in the Dortmund district of Prussia it was required to dismount a horizontal arm of the pump rods; but this was found impossible, owing to the rusting of the bolts and cotters, while the part in question could not be cut through by hammer and chisel on account of the small space at disposal. It was, therefore, determined to effect the separation by means of the electric arc. The energy employed was obtained from a continuous-current dynamo generating 320 amperes at 110 volts, which served for lighting, the negative pole being put in connection with the pump rod and the positive with a carbon of 20 millimeters diameter, held in a well-insulated gas pipe. The latter was fitted with a rest, so that the carbon might be guided by hand, and, for preventing danger from fire, a bucket filled with sand was placed under the spot where the melting was to be effected, while a small hand-pump was also held in readiness. For protecting the men's eyes from the bright light red and green glasses were provided, to be held in the hand. The work was carried through with a current of 320 amperes at 60 to 70 volts, the carbon point being held from 40 to 50 millimeters away from the point to be melted in such a manner that a vertical slot of 20 to 30 millimeters was formed, and then gradually deepened. The guiding of the carbon, which became more difficult as the depth increased, had to be effected in the upward direction, so that the molten iron might fall in drops. The work was performed by six men, who relieved one another every hour or half-hour, in about twelve hours altogether, including a few interruptions. No inconvenience was experienced by the men during the operation; but afterward all of them felt more or less severe pains in the face and hands, while those who did not always use the glasses also suffered in their eyes. The pains, however, lasted only a short time.

Aerial telegraphy is soon to be used extensively in France, if the projects of the recently-formed Paris company are to be carried out. The company, which uses the Popp-Branly system, is shortly to install a central station in Paris of a novel character, and subscribers all over the city will receive the news of the day by wireless telegraphy. The main station will be in connection with the telegraph, telephone, and with the aerial posts outside the city, so that it will be in a position to keep the subscribers posted as to all occurrences of importance, stock quotations, results of races, etc. A certain number of trial posts have already been installed and the system is found to work well. It only remains to apply it on a large scale, and for this the company has been waiting for an authorization from the Minister of Posts and Telegraphs. The company will apply a number of ingenious schemes to supply the subscribers with news. To obtain the results of the races, for instance, which are generally held near Paris, a wireless telegraphy mast will be permanently installed in each race track. An automobile will be fitted out with all the necessary instruments and will constitute thus a movable post. On the occasion of the races it will proceed to the track and connect with the mast, and will thus be able to send all the details of the events to the main station, which in turn transmits them to the subscribers. An extensive system is to be organized on the coast of France. The government has already authorized the company to establish two posts at Havre and Barfleur which will be the beginning of a system which will unite the coasts of France and Algeria. Such a system would be of great value. In the first place, collisions at sea would be rendered almost impossible. Provided with aerial telegraphy outfits, ships could not only signal to the coast at a distance of 150 miles, but also with the ships in the same waters. In case of disaster help can be demanded from the shore or from neighboring vessels. For the national defense the application of such a system is at once apparent. At 150 miles from the coast a simple torpedo boat could announce the approach of the enemy's fleet, and the posts would send the news all along the coast and to the interior.

Engineering Notes.

Reports have been submitted to President E. H. Harriman, of the Southern Pacific Railroad, for the construction of a tunnel nearly seven miles long through the Sierra Nevada Mountains, at a cost of about $14,000,000. Such a tunnel would cut down the summit grade about 1,500 feet, and would enable the company to dispense with all but three of the forty-two miles of mountain snowsheds.

Instead of blowing down coal in mines by means of dynamite, an Englishman intends to make use of a hydraulic cartridge, which is said to obviate the wasteful shattering of the fuel. The cartridge is 20 inches in length. Orifices along its sides admit of the application of a pressure of some 3 tons per square inch. The total pressure is about 60 tons. When inserted in a hole the cartridge is coupled up with a small hand pump. It is said that in a few minutes after the apparatus has been at work, the coal breaks up and falls in great blocks. About 1½ pints of water are used in the operation. One colliery proprietor who has adopted the invention for use in three mines computes that each cartridge saves $75 per week.

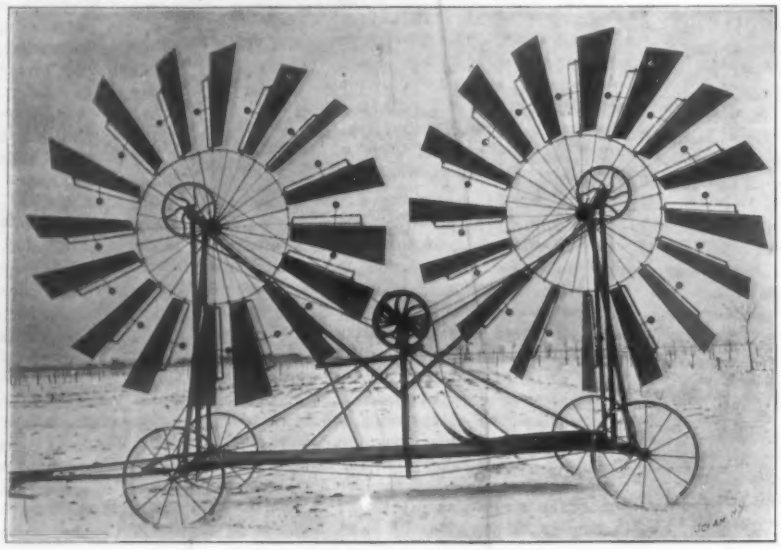
"I remember," said a bridge contractor some time ago while on the subject of workmen's dare-devilries, "when working at the big bridge across the Niagara, when the two cantilever arms had approached within fifty feet of each other, a keen rivalry as to who should be the first to cross sprang up among the men. A long plank connected the two arms, leaving about two and a half feet of support at each end. Strict orders were issued that no one should attempt to cross the plank upon penalty of instant dismissal. At the noon hour I suddenly heard a great shout from the men, who were all starting up. Raising my eyes I saw a man step on the end of that plank, stop a minute, and look down into the whirlpool below. I knew he was going to cross, and I shouted to him, but he was too high up to hear. Deliberately he walked out until he reached the middle of the plank. It sagged far down with his weight until I could see light between the two short supporting ends and the cantilevers on which they rested. He saw the end in front of him do this, hesitated, and looked back to see how the other end was. I thought he was going to turn. He stopped, grasped both edges of the plank with his hands, and, throwing his feet up, stood on his head, kicking his legs in the air, cracking his heels together, and yelling to the terrified onlookers. This he did for about a minute—it seemed to me like forty. Then he let his feet drop down, stood up, waved his hat, and trotted along the plank to the other side, slid down one of the braces hand over hand, and regained the ground. We discharged him, of course, but what did he care? He got all the glory, his fellows envied him, and he could command work anywhere."—Cassier's Magazine.

John Smeaton in 1752 was the first man who ever styled himself a civil engineer, and in the one hundred and fifty years the business has ever been growing more and more of an exact profession, till now it is of equal importance with any of the learned professions, and demands as high a quality of intellect. The business of mining engineering has not as yet reached so high a standard, but is destined to surpass it. The old rule of thumb is being rapidly discarded, and the advance is noticeably greater in the last twenty years than in the preceding one hundred and thirty years. Like the miner, who has had to grope his way painfully upward, the mining engineer has had to be creative in his functions, and cause a demand before furnishing the correlative supply. The scope of the mining engineer is becoming a tremendous one in variety and requirements. He is becoming the master and interpreter of protean forces, and in his functions combines the powers of many branches of practical science. Indeed, all the modern arts and sciences, so far as they apply to mechanics, come under the domain of the mining engineer, for nearly everything to make up modern mechanical progress comes in somewhere as a part of the great mining and metallurgical industry, whether it be the whole railroad system of ore transportation, the pneumatic method in converters, the best efforts of the electrician, the most complex and far-reaching process of the chemist, the keenest effort of the geologist, the profoundest demonstrations of the mathematician. Thus the educational equipment of the mining engineer is becoming necessarily as much more complex than it was as are the appliances at his command in contrast with the simple devices of a generation ago. And if the demands for capacity and knowledge seem great, it is to be borne in mind that the rewards are proportional and commensurate. No youthful profession on earth pays higher salaries to-day than are paid mining engineers, and the world of great mining enterprises stands ready to pay a man the value he himself sets upon his services, provided he can demonstrate his worth as a matter of economy—economy in this regard meaning the judicious expenditure of money.—Mining and Scientific Press.

A PORTABLE WINDMILL.

Instead of using animal power in driving the various machines which are used on a farm, a western inventor, Mr. Amos Wallace, has conceived the idea of making the wind do his farm work for him. Stationary windmills are common enough, but a portable windmill is surely a novelty that merits more than passing notice. And a portable windmill it is that Mr. Wallace uses. The illustration of the windmill which we publish is so clear in its mechanical details that a lengthy description is hardly necessary. The contrivance is mounted on a low four-wheeled wagon which can be readily hauled to and from the field. On this wagon a stout framework is erected at each end. The upright frameworks are provided with bearings to receive the shafts of windwheels. It will be observed that the frameworks are stiffened and securely supported by a system of braces.

Each windwheel shaft carries a sprocket, connected by a chain with a small sprocket, journaled in a standard, which is carried in the center of the wagon. The central sprocket-shaft is fitted with a pulley which receives a driving belt. Obviously the belt can be slipped over the pulley of any farm machine which is intended to be driven.



A PORTABLE WINDMILL.

The China Service of the White House.

Messrs. Josiah Wedgwood & Sons, the famous English pottery manufacturers of Etruria, Stoke-on-Trent, have been engaged to make the new service china to be used on state occasions at the White House. The design has been copyrighted, thus insuring its exclusive use at the President's residence. It is a simple gold Colonial pattern, with the great seal of the United States enameled in colors as the decorative feature. The set will consist of 1,296 pieces, and will be delivered in Washington next January. The ware for this china set will be composed of the best possible china body, and the decorations to be applied will be in the highest style of the art.

RUHMER'S OPTIC TELEPHONE.

Dispatches have been published in the daily press, which state that Ernst Ruhmer, who is not unknown to readers of the SCIENTIFIC AMERICAN, has successfully tested a wireless telephone apparatus of his own invention. A description of the apparatus used will probably not be without interest.

Instead of using the speaking or whistling arc light, Mr. Ruhmer employs a small acetylene flame, thereby avoiding a multiplicity of electrical circuits. The gas is produced in a small generator not unlike that of a bicycle lamp, and is led to the burner. If the diaphragm or membrane of the transmitter be spoken against, the acetylene flame flickers in accordance with the sound waves impelled against the diaphragm. Light impulses of corresponding fluctuating intensity are sent forth into space directly, and also indirectly by means of a small reflector, and encounter a sensitive selenium cell mounted in the rear wall of the instrument frame. If the selenium cell be connected with a source of electricity such as a primary or secondary battery and with two telephones, every word spoken into the transmitter can be distinctly heard in the telephone receiver. In order that the direct sound waves may not give rise to any disturbing sounds the optic telephones are in most instances placed in another room, or some distance away.

That the transmission of the sound waves is effected only through light oscillations can be easily enough proved by inserting between the acetylene flame and the selenium cell, an opaque body, such, for example, as a piece of pasteboard; it will be found that the transmission of the sounds is completely interrupted.

In carrying on experiments at fairly long distances, the selenium cell is detached from its mounting, and in its place a parabolic mirror (Fig. 2) is inserted, which serves the purpose of causing the pencils of light sent forth by the flickering flame to be emitted parallel to one another. It is a well-known optical principle that parallel light waves thus transmitted, travel great distances.

At the receiving station (Fig. 3) the light is collected by a condensing lens and concentrated upon a sensitive selenium cell, which is connected exactly in the manner before described, with a battery and two telephones. There is no particular reason why two telephones should be used—it is simply a German practice. Every public telephone station is fitted with two receivers in Germany.

Fig. 1.—REFLECTOR TRANSMITTER OF RUHMER'S APPARATUS.

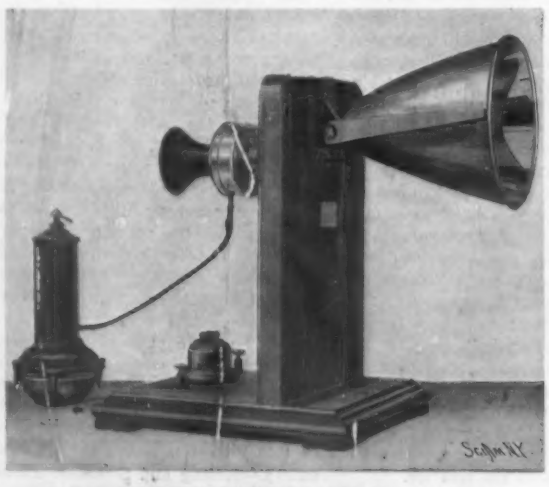


Fig. 2.—RUHMER'S LONG DISTANCE TRANSMITTER.

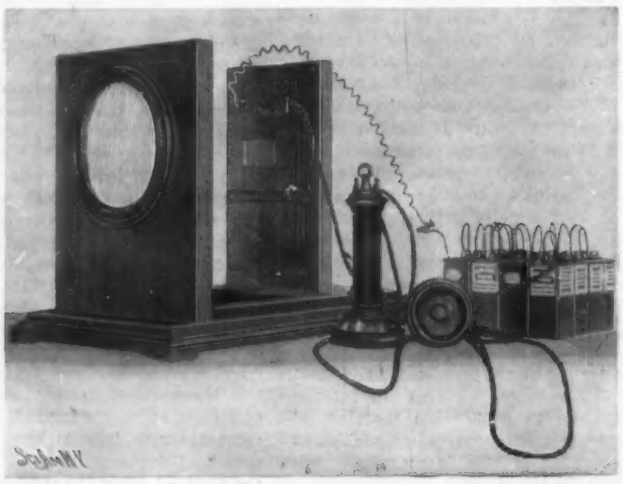


Fig. 3.—THE RECEIVER.

Hamburg's Sea Traffic.

After many years of steady effort the German flag has at last won first place in Hamburg's sea traffic, overtopping the British flag, which for many years had held first place. In 1899 the German tonnage exceeded that of foreigners, and in the same year the Hamburg flag elbowed the British flag out of the first place and forced it to take second rank in the shipping trade of the port. The statistics for 1901 show that the German flag with 4,500,000 register tons put all the other flags combined in the shade, and the flag of Hamburg with 3,600,000 tons maintained its superiority over the British flag, which was credited with 2,900,000 tons. The Hamburg and British vessels trading with the port monopolize between them such a large proportion of Hamburg's trade that they overtop the tonnage of Norway, which takes the third rank, twelve-fold and ten-fold respectively. The Norwegian tonnage last year was 296,000, the Danish 137,000, and the Dutch 116,000 register tons, and the share taken by the other countries—such as Sweden, Spain, France, Russia, etc.—was in every case under 100,000 tons, whereas the coal-laden ships alone from Great Britain totaled up to 774,763 register tons. Non-European and exotic flags are rare phenomena in Hamburg Harbor. Last year only four North American ships, with 5,984 tons, and two Argentine, with 3,180 tons, made their appearance there, and no Chilian or Brazilian vessels arrived there at all..

The network of regular lines spreading out from Hamburg over all the seas to every country on the globe shows the colors of the different maritime nations in about the same proportion and sequence. Connected with Hamburg are seventy-four regular lines under the German flag, thirty-seven under the British, eight under the Norwegian, six under the Danish, three under the Dutch, three under the Russian, two under the Swedish, two under the Spanish, one under the Belgian, one under the French, and one under the United States flag. Of the German lines, thirteen run between Hamburg and Great Britain and thirty-one to ports outside Europe. Hamburg ship owners maintain fifty-six lines between them, ten of which run exclusively between that port and Great Britain. Of the thirty-seven British lines using Hamburg Harbor, six run beyond European waters to America and Africa; and for voyages beyond Europe the boats of two lines partially under the Norwegian flag and one under the American flag also call at Hamburg. No less than 7,114 voyages from Hamburg (3,882 being under the German flag) were prosecuted last year by vessels of the regular lines, of which 969 extended beyond European waters.

Sham Battles With French Submarines.

Some interesting experiments similar to those which would be experienced in actual warfare have been carried out by the French submarine boats, "Gustave Zédé" and "Gymnote" in the naval sham fight off Hyeres in which the efficiency and utility of this fighting arm were strikingly shown. The two vessels were dispatched from Toulon to assist the French Squadron blockaded by the enemy in Hyeres roadstead. The submarines traveled the whole distance below the surface and on reaching the scene of the maneuvers the "Gustave Zédé" was ordered by Admiral Gervais to torpedo the battleship "Bouvet," which feat was accomplished. In the meantime the "Gymnote" having recharged her electric batteries with the help of Admiral Trehouart, advanced in spite of the enemy's torpedo boats, and torpedoed the battleship "Jaureguiberry" and the cruiser "Admiral Charner." The "Gymnote" achieved this feat with only the top of her sighting tube about a foot above the water. The crews of the two large vessels were unaware of the submarine's presence until the missiles struck home. The engine room staffs who had to work upon the submarines in a temperature never less than 100 deg. F. and often 104 deg. fulfilled all requirements; not the slightest breakdown occurred, and the men experienced no fatigue.

THE ZAPOTECAN TOMBS UNEARTHED.

BY WALTER L. BEASLEY.

Professor Marshall H. Saville, of the American Museum of Natural History, has just returned from Mexico, where he has brought to a close the four years of exploration in Southern Mexico planned by the Museum. Two of these years were spent in investigating the famous ruins of Mitla, while the last two seasons' work has been devoted to excavating a number of huge burial mounds in the State of Oaxaca. The funds for the expedition were furnished through the liberality of the Duke of Loubat. At Oaxaca a series of spacious and elaborate tombs were uncovered, wherein were found a number of noteworthy and surprising objects of great archæological interest and value. These afford for the first time a vivid glimpse of the civilization of the little-known race, the ancient Zapotecans, a powerful Indian tribe who had developed a peculiar culture, differing in many respects from the Aztecs of Mexico, and the Maya of Yucatan. The relation of their culture to that of the other Mexican tribes, an important archæological problem, can now be more narrowly studied than ever before.

Professor Saville's brilliant discoveries, when fully reported on, will unquestionably be one of the most important contributions to American archæology made in recent years. The excavations of the past and preceding winter were carried on in two places near the city of Oaxaca, Xoxocotlan and Cuilapa, all in the area of Zapotecan culture. Not far distant from these points is a range of hills on which are situated the remains of a great fortified city, known as Monte Alban, which is thought was probably the capital of the old Zapotecan empire. This entire section is dotted with mounds indicating a thickly populated province in former times. The mounds vary in height from 6 to 75 feet. A number are in the form of a pyramid, others rectangular in shape, and a few circular. Many had been plowed over, and thus their original outlines were destroyed. The excavations of the mounds revealed much that was new and surprising. The doors of the tombs were sealed by a large stone. A peculiar feature of the ruins were cement floors, sometimes one above the other and about a foot apart, indicating a structure on top. A flight of stone steps led upward in several instances to the platform or floor above. The tombs were built of slabs of stone, neatly dressed, covered with stucco and were painted red. The lintel over the entrances consisted of a long block of stone, the outer part painted in red. Above this were stucco decorations, sculptures, hieroglyphics, and in some instances funeral urns of terra cotta.

In the principal excavation made at Xoxo a trench was carried through the entire mound. Here were found the cement floors and adobe construction characteristic of other mounds. The door was sealed with a large stone. The façade of the front wall was in the form of a frame, in which were placed five terra cotta funeral urns. On either side of the one in the center was a death's head of stucco. These funeral urns, which had been fastened to the wall with cement, were the covers of boxes of terra cotta resting on four feet, the corner of each box being decorated with symbolic faces. The inside of the tomb was found literally covered with food vessels, incense burners and the remains of a number of skeletons. The niches on either side of the walls also contained human remains. All of the bones and skulls were painted red. There were several decapitated heads on the floor. The walls of the chamber were formerly entirely covered with plaster, but during the lapse of centuries, probably on account of the action of earthquakes, the greater part had fallen off. They had, originally, been entirely decorated with paintings in various bright colors, traces of which were distinctly visible. Over these bright colored paintings a thin coat of stucco had been laid upon which in black outlines was painted a series of human figures in the costume of ancient Mexico. The most important feature in this and many of the tombs was the hieroglyphic inscriptions, found on the stone door lintel and wall chambers in a form of writing entirely different from any heretofore known in Mexico, and the first ever found in Zapotecan territory. When deciphered these inscriptions will doubtless shed valuable new light upon this ancient race.

ZAPOTECAN TOMB AT CUILAPA.

At Cuilapa, seven miles southwest of the town of Oaxaca, seven large chambers and a like number of small stone graves were uncovered. The excavations of the mounds at Cuilapa were especially noted for the great numbers of magnificent jadeite ornaments and other votive offerings found. These embraced beautifully carved breast ornaments, necklaces, beads, earrings, miniature idols and various symbolic figures. Also fragments of mosaic work were found, the most interesting of which are two small circular mirrors made of bits of highly polished hematite cemented to thin disks of pottery. A significant point brought out by the excavations is the fact that they fully confirm the writings of the old Spanish historians of that age as to the strange and elaborate burial customs employed by the Zapotecans. Also that the great underground tombs are properly ossuaries or places where the bones only of the dead were deposited. After a certain lapse of time, when the flesh had decayed, with elaborate ceremony the bones and decapitated heads were painted red and placed in the tomb with food and incense. Funeral urns were found to have been placed in series of five in front of the tombs. One problem was definitely settled as to the exact character of the mounds; those of rectangular shape were found to be burial places and contained the most important tombs, while the pyramidal ones were temple structures. The first detailed account of these explorations herein outlined are now given by Mr. Saville before the International Congress of Americanists at the Museum, where new archæological and ethnological problems and the early history of the two Americas are being discussed. This will be followed by the publication of two illustrated memoirs, one on the ruins of Mitla and the other on the excavations of the Zapotecan tombs; these will be the latest and most exhaustive works on the culture of the ancient civilizations of Mexico in existence.

TERRA COTTA FUNERAL URNS AND BURIAL FIGURES.

TEROPLE MOUND.

A New Type of Electric Locomotive.

Some interesting tests have been carried out with a novel and interesting type of high-speed electric locomotive designed by Mr. Walter Reichel, the chief engineer to Messrs. Siemens & Halske, the eminent firm of electrical engineers, which in conjunction with the Allgemeine Elektricität-Gesellschaft has been carrying out the elaborate experiments in connection with high-speed electric traction. The body of this new locomotive is carried on two four-wheeled bogies, and to each axle a motor is fitted, making four motors in all. The special feature of this engine is that the motors receive the current direct from the supply trolley at 10,000 volts potential, and the fitting of a motor to each axle dispenses with transformers and enables the weight to be considerably reduced, with a corresponding reduction of energy consumption. The reason for building a locomotive instead of another automobile car, for these high-speed trials, was simply the lower cost. Owing to the imperfections of the permanent way, the maximum speed attained in the trials was only 105 kilometers (66 miles) an hour, but they afforded ample proof of the feasibility of using motors taking current at very much higher pressures than have hitherto been attempted. Pressures extending up to 11,000 volts were used in the trials without giving rise to difficulties of any kind. According to the engineer, the substitution of these motors in the Siemens & Halske high-speed car employed in last year's trials for the 1150-volt motors and transformers then used, would reduce the weight from 96 to 76 metric tons. This car attained a speed of 160 kilometers in the former trials, and if, when carrying 50 passengers, it were coupled to a 42-ton car without motor equipment, the total weight, taking 7 tons as the weight of 100 passengers, would amount to 125 tons, or 1.25 ton per passenger.

Power Exerted by Water.

The tremendous power exerted by water in violent motion is well shown by some experiments carried out by English engineers to determine the stress exerted upon the foundations of a lighthouse. Thomas Stevenson discovered that at Skerryvore and Bell Rock pressures of 6,083 pounds per square foot, and 3,013 pounds, respectively, were to be encountered in ordinary weather. This is only about 42 pounds per square inch, and is doubtless much exceeded in severe storms.

Patent Department

TRAPS FOR THE UNWARY INVENTOR.

We have had occasion from time to time to call attention to the practices of "Patent Sales Agents" in inducing patentees to place in their hands the sale of their patents. The ordinary method employed in carrying out this work is to write to the inventor, informing him that his device has been carefully examined and has been found to possess great merit; that it is believed by bringing the invention to the attention of the proper people (whoever they may be) there will be no difficulty in finding a purchaser. The fact is then adroitly set forth that in order to carry out this work, much time and labor will be required, and though the patent will be sold on a purely commission basis of from 5 to 10 per cent, or any other similar amount, in order to cover the necessary expenses for printing circulars, providing models, conducting correspondence, or for some other similar cause, a retaining fee is required, payable in advance. This is not the universal method employed by the "Sales Agents," but it is the most popular method, and such offers should be carefully looked into. The integrity of the parties should be thoroughly examined into before any credence is placed upon their claims.

There is another method of procedure, however, which has reached any considerable importance only within the last year or two. The service performed by these parties is an actual service for which the parties in question are perfectly entitled to proper remuneration. In some cases, however, the methods employed by them are irregular, and the results to be obtained elusive. The very respectable character of the parties who solicit this class of business renders it necessary to make a thorough investigation before placing any business in their hands. As a rule, they advertise themselves as being bankers, or as being corporation lawyers, and the method of procedure is somewhat as follows:

Soon after the inventor has received his patent and has received the usual notice in the Official Gazette, he will receive from Mr. A. B., a banker, a carefully and innocently written letter, stating that the said A. B. has examined with great interest the inventor's patent and has not only become convinced of its great worth, but has a customer who wishes to invest in the invention. He states that before doing so, however, it is necessary to have a thorough examination made into the validity of the invention. Correspondence is solicited upon this subject, and later on the "banker" will advise the victim that he knows of a very competent lawyer, Mr. X. Y., who will undertake the examination into the validity of the patent and will report upon its status, and that it is quite necessary to have the search made and the report prepared before the sale can be concluded. The fee for making the infringement search is, of course, very considerable, and when the report is rendered it is drawn in such a way that the intended investor decides that he will withdraw from further negotiation, and the sale is, therefore, never concluded and the matter is quietly dropped, the object of the whole transaction having been attained in the large fee which has been exacted from the inventor for the infringement opinion.

The matter, however, may take a somewhat different form, and Mr. A. B. may write to the inventor and state, as in the former case, that he has a client who is extremely anxious to purchase the invention. In order to carry out the plans of the client, however, it is necessary to form a stock company. The amount of stock at which the company is to be capitalized is generally placed at an enormous sum, according to the nature of the invention; anywhere from $50,000 to $5,000,000 may be named as the proper amount at which the company should be capitalized. The innocent or unsophisticated inventor is naturally dazzled by the enormous wealth which is soon to be his. In order to place the matter on a proper business basis, however, it is necessary that the company should become incorporated. It is necessary that this work should be placed in the hands of a competent corporation lawyer, and the latter is adroitly drawn into the transaction. The fee which he exacts for attending to this service of incorporation is very liberal and is paid by the inventor. When the company is formed and the handsomely engraved stock has been issued, the inventor discovers that the interest of all parties concerned, as in the former case, suddenly languishes, and the inventor awakes to the fact that he has parted with his patent to a phantom company and holds in lieu thereof a quantity of worthless stock with which he can do nothing. Of course, the character of the pretensions of the promoter can be tested by insisting upon a cash payment as part of the consideration, and the inventor should refuse to make any advancement for the incorporation of the company until such demand shall have been satisfied, or until the financial responsibility of the contracting parties has been carefully looked into, and the desire of the purchasers to acquire an interest in the patent has been proved to be *bona fide*.

Prize for Locomotive Driving Mechanism.

The Verein Deutscher Maschinen-Ingenieure has offered the sum of 10,000 marks ($2,500) in prizes for the invention of a driving mechanism for passenger locomotives.

Complete working drawings of a locomotive are wanted, which is capable of drawing on a straight-away road a load of about 180 tons at an average speed of 72 miles per hour for three hours without stopping. The water supply can be replenished at intervals of 72 miles. The maximum speed of the train should be 150 kilometers (90 miles) per hour. The inventor, besides furnishing a complete description and statement of the efficiency of his locomotive, must also supply a computed statement of disturbing motions.

Furthermore, the Society offers a prize for the complete working drawings of a railroad coach which shall travel smoothly and safely at a speed of 90 miles an hour, and which is so constructed that the passengers will be as fully protected as possible in case of accident. Particular attention should be given to apparatus for ventilating, heating and lighting the coach. The brakes should be of such type that the train can be brought to a standstill in a short time. Provision should also be made for the serving of refreshments to passengers during the journey.

In general the inventor should keep in mind the provisions which have been made for the construction of rolling stock for the main German lines, as well as the standard German gages. The car couplers may be of any approved style. The drawings are to be drawn to a scale of 1 to 20; details on a scale of 1 to 1, 1 to 5, and 1 to 10. Participants in the contest should be Germans, or else employés of a locomotive or car works situated in Germany. The first prize is 5,000 marks ($1,250); the second prize is 3,000 marks ($750); the third prize is 2,000 marks ($500); special prizes may also be awarded in the discretion of the committee for special work.

The Society retains the right to publish either full or partial descriptions of the designs which have received prizes. All plans must be submitted by 12 o'clock M. on December 1, 1902, to the Secretary, Society of German Locomotive Engineers, F. C. Glaser, Berlin, S. W., Lindenstrasse 80, I, Germany. The plans must be submitted under a *nom de plume*, which is written upon the drawings and also upon a sealed envelop inclosing the real name of the inventor.

Artificial Marble in Denmark.

The lack of marble in Denmark has led to many attempts to produce a substitute which would equal in decorative effect the natural product and would not exceed it in cost.

Some success has been achieved in the manufacture of this article in Sweden, but the thin slabs would not keep their shape, inclining to bend and warp. The veins were stiff and angular, and the soft transitions of color which make variegated marble a thing of beauty were wanting.

A significant advance has been made in this industry by a Danish master builder, who is producing a stone of such delicate transition of tints and play of color that it is impossible to distinguish it from the natural product; while as to cost of manufacture, it can compete with all other artificial marbles. The imitation of the more expensive species does not exceed in cost that of the cheaper ones.

The inconvenience hitherto met with, that the mass had to be greased to prevent adhesion (thereby destroying the crystalline surface characteristic of the genuine article), has been overcome.

The process of manufacture is simple and easily learned, and the cost of the outfit does not exceed $175. The article can be produced in any form desired—columns, plain or fluted, and capitals—as readily as flat slabs. It is claimed that even pictures may be made of this material. It seems to have the durability of genuine marble, but its cost is only about one-tenth as much. At the present stage of the development of the industry, the maker is able to produce a slab about half an inch thick at a cost of 14 cents per square foot.

The inventor's name is Soren Schongaard, and his address is Copenhagen.

Germany's match-making industry, in which about $9,000,000 is vested, is said to be almost ruined by the output of the American Diamond Match Company's new factories near Mannheim. Six months ago matches made in German works were sold at $20 a case; now they are selling at $16 a case, which is a dollar below the cost of production by German machinery. The Diamond Match Company uses machinery made in the United States.

Brief Notes Concerning Patents.

According to the New York Sun, John W. Bookwalter refused $1,000,000 for the patent rights of a new steel process which he has invented. By means of this process it is possible to remove impurities from iron at the side of the converter instead of at the bottom. It is said that less power is required and that a steel of greater purity is obtained.

Hugo Jone, a chemist in the city laboratory of Chicago, has devised a battery for the production of electricity directly from coal. The city is paying the expense of the experiments which Mr. Jone is carrying out. The new battery is said to be in practical and convenient form.

On October 22, Professor Sidney Howe Short, the inventor of the first electric car operated in the United States, and consulting engineer of the Dick, Kerr Electrical Company, died after an operation for appendicitis. He had been engaged in electrical work for twenty-four years. Professor Short was graduated from the Ohio State University in 1878. He established the Short Electric Railway of Columbus. He was a professor in the Denver University for several years and during that time he invented his car, which was tried on the University's grounds.

A lieutenant-colonel in the Swedish army, Mr. G. Baunerhjelm, has for some time experimented with wireless telegraphy (Marconi's system). It is claimed that he has recently made improvements in this line which, if practical, will be useful for military purposes and at sea. The newspapers state that he has invented an electric radiator or reflector which, combined with the Marconi system, can send the electric waves, and with them the message, in the desired direction. The drawback of the system seems to be that a telegram cannot be sent in a certain direction a longer distance than 25 or 30 miles, but for many purposes this may be sufficient. The experiments will be continued, and further improvements may be made.

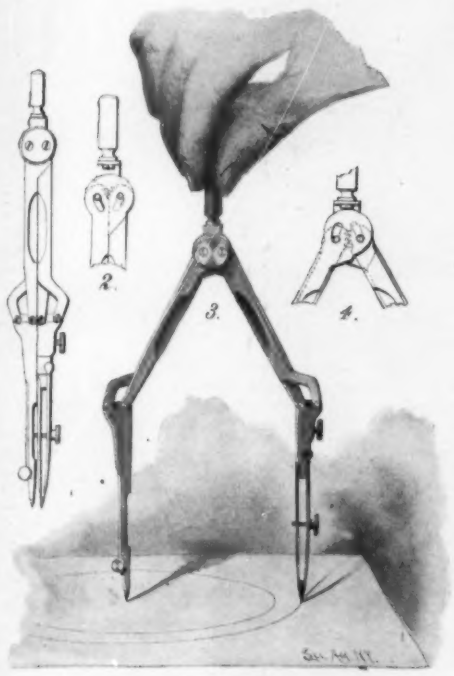
An exhibition of the Carley life float which has been attracting an unusual amount of interest among shipbuilders, yachtsmen and marine enthusiasts, was given September 23 on the lower bay off Romer Shoal Beacon. The exhibition itself was most successful and many eminent authorities volunteered the opinion that the Carley float was a most effective life-saving appliance. The float was easily tossed over the bulwarks of the steamer. Eighteen men jumped into the water and climbed into the float. This float was designed to hold fifteen people, yet the eighteen, whose aggregate weight was somewhere in the vicinity of 3,000 pounds, failed to submerge the cylinder, and experts admitted that it would save the lives of almost as many more clinging to the lifelines outside.

A curious condition of affairs as to the rights of inventors who are also public servants, in the employ of municipal bodies at the time of an invention, occurred in England recently. One of the officers of the London County Council invented an apparatus to record the force of water issuing from a hydrant, and the patent therefor was claimed and assigned to the Board. It thereafter appeared that the use of public funds for paying renewals was forbidden by law, so the Board was compelled to reassign the patent to the original inventor for his own benefit—ostensibly—stipulating that the Board should have the use of the device without charge, free of royalties for the term of its life, and also that the name of the Council should not be used in connection with the sale of the invention to outside parties. This seems an ingenious stratagem to obtain the device without any payments whatever, leaving the inventor to maintain the patent in force for the Board's use. Outsiders would scarcely care to invest in such an invention, when the chief source of profit—public use—was taken from it.

An article in the Edinburgh Evening Dispatch on india-rubber has brought the suggestion that the real inventor of waterproof was not Mackintosh, of Glasgow, but Prof. J. Syme, of Edinburgh. It is claimed on the authority of a book sent by Prof. Chiene, of Edinburgh University, that Prof. Syme published in 1818 an article in the Annals of Philosophy, announcing his discovery of benzene and its solvent power on caoutchouc. Having dissolved the rubber, Prof. Syme relates that he rendered various textures (such as a silk cloak) waterproof by brushing with a thin solution. The article did not appear in the Annals until some months after he had sent it, and not long afterward Mackintosh took out a patent for applying the solution to make water-proof cloth. A correspondent says even if it were true that Syme discovered that benzene would dissolve india-rubber, that in no way proves that he invented waterproof. India-rubber can be dissolved by many things, such as turpentine, naphtha, and ether, and before 1820 india-rubber was dissolved and used for commercial purposes by Mackintosh, of Glasgow, who used coal-tar naphtha, and by Hancock, of London, who used turpentine.

IMPROVED DRAWING COMPASSES.

In order to draw a perfectly smooth ink line it is necessary to hold the drawing pen at such an angle that both blades will at all times bear evenly on the paper. While this is a very easy thing to do with the ordinary drawing pen it is quite a different matter when a pen compass is used. In adjusting the pivot leg and drawing leg to a certain desired radius the draftsman has to operate not only the main joint at the handle, but also the knee joints in each leg, so that the needle and pen sections lie parallel with each other. This is a matter of considerable difficulty for the novice and is often a source of annoyance to even the experienced draftsman. A very useful invention,



IMPROVED DRAWING COMPASSES.

therefore, is the one herewith illustrated, for which patents have recently been granted to Mr. C. Brandell, Austin Station, Chicago, Ill.

From the detail views 2 and 4 it will be observed that the main legs of this compass turn on separate pivots, spaced apart, also that the heels or pivotal ends of these legs are provided with gear sections which respectively mesh with each other, so that the legs move simultaneously to open or closed position. Outside of these main legs are the auxiliary legs, also mounted on the two pivots mentioned. It will be observed, however, that the right auxiliary leg turns on the left pivot, while the left auxiliary leg turns on the right one. At their lower ends the two left legs are pivotally connected with the needle-point section and the two right legs with the socket for the pen or pencil. By reference to Figs. 1 and 3 it will be seen that these pivots at the lower ends of the legs are equally spaced and lie in the same horizontal plane as the main pivots at the top, so that when the legs are spread apart the needle-point and the pen or pencil, acting on the principle of the parallel ruler, always lie parallel with each other. If desired, a lengthening bar of special design may be used. The shank at one end of this bar should lie parallel with the socket for the pen at the other end, but at right angles with the main bar. The extension bar may be made hollow to receive an extension from the socket-piece, so that the parts may be thereby adjusted to a greater radius. Since the tubular lengthening bar stands at right angles to the shank, and the pen or pencil at right angles to the bar, it follows that when the compass is opened or closed, the pen or pencil will stand at right angles to the needle point, the same as if the lengthening bar had not been used.

TOOL FOR WITHDRAWING CASINGS FROM WELLS

A tool has recently been invented by Mr. S. Bennison, of Galveston, Tex., which is adapted for releasing and withdrawing the metal casing of an Artesian water-well or an oil well either entire or in sections when this is desired.

Two forms of the device are here illustrated; that shown in Figs. 1 and 2 is a lifting implement and will operate very effectively to engage and grip the casing section which is to be bodily withdrawn. It will be observed that the tool comprises two chuck-jaws of semi-cylindrical form having a series of upwardly inclined teeth cut on their peripheries. The jaws when assembled form a cylinder, through the axis of which a tapering channel is formed to receive a wedge block of rectangular cross section. Preferably, the side faces of the wedge block are longitudinally fluted so as to reduce the frictional contact with the jaws and permit the introduction of a suitable lubricant. The lower ends of the chuck jaws and wedge blocks are tapered, so as to serve as a reamer for removing any dust or dirt that may have accumulated in the casing. The wedge block is formed on the end of a hollow stem of sufficient length to reach the upper end of the well casing. The jaws are yieldingly held together by spring bands which surround them at the top and the bottom, and in order to prevent the parts from getting lost down the well the jaws are secured to the stem of the wedge block by chains.

Fig. 1 shows the position of the parts when lowering the device into the well; when in proper position within the casing the stem is pulled upward and the wedge block acts to spread the clutch jaws, sinking their teeth into the inner surface of the casing section, as shown in Fig. 2. Thus a firm grip is secured and the section may be drawn up upon the application of sufficient power. To loosen the casing in the bore when the well is dry, water may be freely introduced through the bore of the hollow stem.

In some instances, the sections must be removed one after the other, as it may be impossible to draw the casing intact from the bore of the well. It will then be necessary to rotate the casing section, in order to unscrew it from the next section below. On such occasions the tool shown in Fig. 3 will be found useful. The construction in this case differs from that just described only in the arrangement of the teeth, which in this case, are formed longitudinally on the clutch jaws. The cap secured to the upper end of stem is adapted to receive a lever which, after the jaws have been spread, may be operated to unscrew the casing section from the next lower section.

OIL BURNER.

The present scarcity of coal has brought into prominence many heating devices designed to burn a substitute fuel. The oil burner which is illustrated herewith deserves special notice from the fact that it is designed to be used in connection with the ordinary kitchen range; the device, however, is not attached to the stove, but may be immediately removed when desired. The burner is adapted to burn crude petroleum and produce a very strong, hot flame. Due to its simplicity, the construction will be understood at a glance. The stove is provided with a stove-lid having a central opening to admit a down-draft tube. Below this tube is placed the burner proper, which is made in the form of a cup with a conical bottom. At the apex of this cone is a depression into which oil is dropped, as shown, from a suitable reservoir.

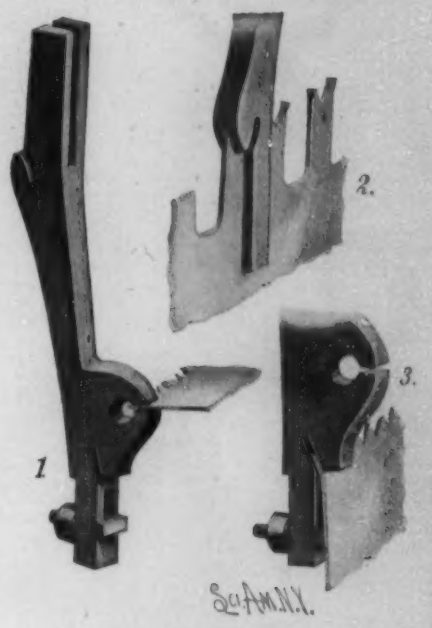
In operation, the oil will drop or run from the supply-pipe through the down-draft tube with such force that when it strikes the apex of the cone it is atomized in the burner. Here it will be ignited, sending up a very strong flame, for all of the other drafts or openings are closed and all air for supporting combustion will be necessarily drawn downward through the down-draft tube, while the products of combustion will pass up through the stove-pipe. The inventor of this oil burner is Mr. E. Stewart, of 601 Milton Avenue, San Diego, Cal.

OIL BURNER FOR USE IN KITCHEN RANGE.

SAW-TOOTH TOOL

The invention which is herewith illustrated provides a very convenient tool for operating on the teeth of cross-cut saws; it affords a means for setting the teeth and a means for straightening the teeth, and a device for spreading or swaging the drag-teeth, all of which features are embodied in a single tool.

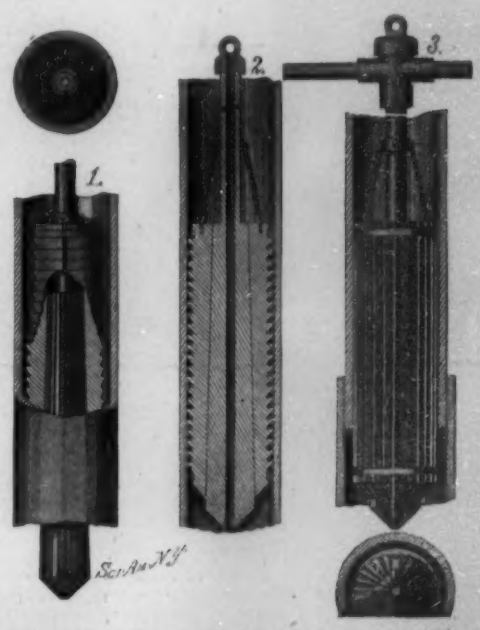
The device, as shown in Fig. 1, comprises a body portion having near its lower end a lateral projection provided with a slot to receive a saw-tooth for the purpose of straightening the same. At the base of this



A SIMPLE SAW-TOOTH TOOL.

projection is another slot used in setting the saw, as in Fig. 3. A clamping-bolt passes through a longitudinally disposed slot in an extension at the lower end of the tool, and is provided with a gage block adapted to bear against the face of the saw blade. After adjusting this block to the required position against the blade and inserting the tooth in the slot above, a sharp tap with a hammer on the upper end of the tool will cause the proper bending or setting of the tooth.

The upper end of the tool is provided with spaced members adapted to straddle the saw, as in Fig. 2, when it is desired to swage the drag-teeth. At the base of these members is a forming-tooth adapted to be inserted between the double points of the saw-teeth; now, by a sharp blow of a hammer the forming-tooth may be pressed down between these points to properly spread or swage the saw-teeth. From the foregoing description it will be seen that the tool fills all requirements in the proper setting of cross-cut saws. A patent for this invention has recently been granted to Mr. Torbjorn Olsen, 242 Meacham Street, Manistee, Mich.



TOOL FOR WITHDRAWING CASINGS FROM WELLS.

RECENTLY PATENTED INVENTIONS.

Apparatus for Special Purposes.

APPARATUS FOR IMPREGNATING WOOD.—W. L. SMITH, New York, N. Y. This apparatus provides means for treating wood rapidly and under high pressure to make the same fireproof. Means are provided in the apparatus for regulating the pressure. An auxiliary testing cylinder is employed in which comparatively small strips of wood may be placed and subjected to the same treatment as the timbers in the main cylinder, so that the treatment may at times be observed without the expense of drawing off the large amount of solution in the main cylinder and removing the wood therefrom.

APPARATUS FOR GENERATING MOTIVE POWER.—L. D. COPELAND, Los Angeles, Cal. Motive power with this invention is generated by bringing water in contact with molten or hot furnace slag. The molten slag is fed into the generator casing and brought into direct contact with water contained therein. Heat contained in the slag is quickly absorbed by the water, owing to the granulation of slag.

APPARATUS FOR STEAMING CLOTH.—W. HEBDON, Brooklyn, N. Y. Mr. Hebdon provides in this invention an apparatus for shrinking and finishing woolen cloth of all kinds. An improved device is provided for steaming the cloth during the shrinking and finishing process, which insures a thorough and even setting of the fibers to give a firm and permanent finish to the cloth.

SLAG STEAM-GENERATOR.—L. D. COPELAND, Los Angeles, Cal. Two patents have been granted to Mr. Copeland under this title. The steam generator which is simple and durable in construction is arranged to permit control of the operating parts by the workmen to prevent escape of the steam when recharging with molten slag and to insure complete utilization of the units of heat in the slag for converting the water into steam.

The second invention provides an improved device for feeding the slag into the receiving receptacle contained in the closed generator. Means are also provided for readily emptying the contents of this receptacle and breaking up or dividing the slag to insure utilization of all the units of heat contained therein.

Hardware.

SASH-FASTENER.—E. A. SACKETT, J. C. ANDERSON and G. P. BETTS, Denver, Colo. This invention is an improvement in that class of window-sash fasteners in which the body of the device is secured to the sash or casing, and a slidable member is connected therewith in such a manner that it locks the sash in one position when engaged with a socket formed in the adjacent casing, or if the device be attached to the casing then the engagement of the sliding member is with the sash.

SCRAPER FOR PANS, KETTLES, ETC.—J. W. CRAWFORD, Appleton, Wis. Mr. Crawford's invention is an improved device for scraping and cleaning pans, pots, kettles, kitchen utensils, etc. The device consists of a straight bar and a curved bar, having beveled side edges and ends and provided with a handle which extends between the two bars and serves also as a brace. Any surfaces whether flat or curved may be conveniently scraped and cleaned with this implement.

COMBINATION-LOCK.—J. W. GONCE, Kinderhook, Ala. Mr. Gonce has invented certain improvements in keyless combination-locks which have for their object to simplify the construction and reduce the cost of manufacture, also to prevent liability of disarrangement or breakage of the parts.

DETACHABLE SAW HANDLE.—C. W. STITES, New York, N. Y. In a previous invention Mr. Stites produced a saw handle which could be conveniently detached from the saw blade. His present invention provides certain improvements on the original handle whereby it is rendered more simple and practicable and the cost of manufacture is reduced.

SPRING COUPLING PIN.—E. DODD, Adelaide, South Australia. The spring coupling is designed for securing together two parts, such as connecting the poles and shafts to a vehicle, or as in a D-shackle forming the coupling between two chains, rods, or parts of machinery. It is adapted to take the place in many instances of a bolt and nut, and consists of a pin with a spring extension and a detaining catch, all formed in one piece and capable of being inserted and withdrawn without the use of tools.

Miscellaneous Inventions.

HANDLE-BOLT.—A. W. TERRILL, Salem, W. Va. This hand bolt is designed for use more especially on sectional wooden rims of bull-wheels employed in gas and oil well drilling machines. The bolts are arranged to securely fasten the rim sections together and provide convenient handles for turning the wheel.

MAIL-BOX.—P. P. I. FYFE, Concord, N. C. An improved mail box for use in delivering and collecting mail has been invented by Mr. Fyfe. It comprises a structure adapted to be set in the wall of a building, one side of the structure being located at the outside of the building, and other at the inside, so that the postman may deliver or collect mail from the outside of the wall and the occupant of the building may post or receive mail from the inside thereof.

BOILER-CLEANER.—J. W. CONE, Barnesboro, Pa. A simple and efficient boiler cleaner is hereby provided which is adapted to blow off impurities at the surface of the water in the boiler, and to discharge sediment at different portions along the length of the boiler at the bottom thereof.

SCREW CONVEYER.—J. A. MITCHELL, Brooklyn, N. Y. If an ordinary screw is placed in a conveyer trough and material fed to it along its entire length, the mass of material gathered by the screw is rolled entirely around and the screw discharges no more in a given period of revolutions than would be discharged in the same period were the material fed merely for a distance along the screw equal to its pitch. By means of this invention, however, the screw may be fed along its entire length and owing to its peculiar form will discharge—say, for example, in one revolution—an amount of material equal to that received by it during such revolution.

SNOW-PLOW.—W. W. FOSS, Goodhart, Mich. This improved snow plow is arranged for attachment to a road machine and is adapted to open a road covered with snow. The plow has a very simple and durable construction and will move the snow sidewise without requiring much power to move the plow forward through the snow.

OIL-BURNER.—C. W. SIEVERT, Los Angeles, Cal. Mr. Sievert is the inventor of an improved device for burning oils, particularly the heavy oils, such as crude petroleum. The device comprises certain novel features which co-operate to effectively gasify the oil and mix it with air, so as to obtain thorough combustion.

PUMP.—G. E. GREEN, Greencastle, Mo. This pump belongs to the class commonly known as "doubleacting"—that is, pumps having means for causing a continuous flow of water from the egress-tubes. Certain improved details of construction are provided by the invention.

MOLD.—O. NOLAN, Minneapolis, Minn. Mr. Nolan is the inventor of an improved mold for forming artificial building stone. The principal object of the invention is to provide a mold of simple construction in which the stone may be quickly and uniformly made.

AUTOMATIC STOVEPIPE DAMPER.—R. G. SMITH and J. H. MATHIS, Forrest City, Ark. These inventors provide the branch pipe of a furnace, range or heating stove with a novel, simple appliance which is operated by the expansion and contraction of the draft pipe due to changes in its temperature, so as to correspondingly adjust the damper in the pipe, and thus automatically control draft therethrough. The damper is applicable to both vertical and horizontal pipes or ducts.

ACETYLENE-GAS GENERATOR.—W. J. LOYER, San Marcos, Tex. This generator belongs to that class in which the carbid receptacle or holder is arranged on the top of the gasometer or bell placed in a water tank. An improved automatic valve mechanism is provided for effecting the discharge of the carbide into the water-receptacle, as may be required to increase the supply of gas. The operation of this mechanism is effected by the descent of the gasometer below a predetermined point.

NON-INTERFERING HORSESHOE.—J. T. BROACH, Churchland, Va. The shoe embodying this invention overcomes the necessity for the use of boots and leg protectors, allows the shoe to be equipped with toe or side weights or the weights may be dispensed with, and the horse cannot cut the quarters of one leg by the shoe on the other hoof. The article when worn has a tendency to make the horse naturally throw the hoof in an outward direction.

Designs.

DESIGN FOR A HANDLE FOR SPOONS OR SIMILAR ARTICLES.—N. H. ANDRUS, Nebraska City, Neb. The design includes the representation of a trunk of a tree with root branches extending along the opposite edges of the upper portion of the bowl of a spoon. The trunk extends upwardly upon the face of the spoon handle, and has diverging branches extending toward the middle of the same. Foliage is presented alongside the trunk upon the face of the handle, extending at the upper end around the opposite sides of a panel. On the rear of the handle is produced the representation of the trunk with branches extending along the upper edges of the bowl of the spoon and with foliage along the edges of the handle. A tree is produced on the back of the handle near its upper end.

DESIGN FOR SHADE CLOTH.—J. H. WRIGHT, New York, N. Y. The design consists of rows of shell-like figures, the figures spaced apart in one row being above the spaces between the figures of an adjoining row. Each figure consists of a number of segmental nested lines of varying thickness.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Dies, tools, models. Am. Hardware Co., Ottawa, Ill.

Inquiry No. 3315.—For the makers of the "Naphey" acetylene gas burner.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 3316.—For the makers of the Duplex motor.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 15, Montpelier, Vt.

Inquiry No. 3317.—For manufacturers of vending machines.

FOR SALE.—Patent on reversing mechanism for launches, etc. S. N., 195 Amity Street, Brooklyn.

Inquiry No. 3318.—For parties to make small steel or malleable iron castings.

Machinery designed and constructed. Gear cutting. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 3319.—For manufacturers of dynamos operated by windmill power.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 3320.—For manufacturers of sorghum mills, with attachment for cutting the bagasse as it leaves the mill.

ONYX.—Highest grade, domestic stock, unlimited supply, low freight rates. Very attractive proposition. Address "Onyx," P. O. Box 773, New York.

Inquiry No. 3321.—For planting machines for setting and watering in one operation.

Clippings of everything printed on any subject in the American and foreign press. United States Press Clipping Bureau, 153 Lasalle Street, Chicago, Ill.

Inquiry No. 3322.—For a patented box or crate which can be taken apart and returned to consigner.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and band organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 3323.—For a machine for preparing cotton for felt mattresses.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 3324.—For makers of brick-making machinery.

Patent for Electric Call as explained in this paper October 4. For sale outright or State rights. J. Salmon, 340 West 23d Street.

Inquiry No. 3325.—For makers of light gasoline or other motors.

Practical Novelty Co., 450 Walnut St., Philadelphia, Pa., issue a 32 p. book in colors, describing their method of keeping the clothing in perfect shape. Free on request.

Inquiry No. 3326.—For parties dealing in rhodium.

WANTED.—First-class machinery draughtsman. (One with gas engine experience preferred. Address giving references. to Holland Torpedo Boat Company, New Suffolk, Long Island, N. Y.

Inquiry No. 3327.—For an outfit for making halftones.

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A prominent business man of New York City writes that he would like to come in touch immediately with a few well-recommended persons who are desirous of a higher education. This party has at his disposal a limited number of Free Tuition Contracts in the following courses: Electrical Engineering (including Interior Wiring and Lighting, Electric Railways and Telephone and Telegraph Engineering), Practical Electricity, Illustrating, Caricature, Ad-writing, Journalism, Proof-reading, Bookkeeping and Stenography. There is absolutely no expense for tuition, if you are awarded one of these contracts, the only cost to you being postage, etc., and you can pay these during the first four months. We would strongly recommend that you write to this gentleman, if you are ambitious to get ahead. Address W. L. B., Box 3757, New York City, and enclose your references, and be sure and mention Scientific American.

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Inquiry No. 3329.—For manufacturers of revolving brushes similar to those in carpet sweepers.

Inquiry No. 3330.—For manufacturers of laundry machinery.

Inquiry No. 3331.—For manufacturers of stamped goods of German silver, or some white metal less expensive than aluminium.

Inquiry No. 3332.—For manufacturers of sixpenny sticks of welduminium patented by Power & Webster, said to be manufactured by W. W. Armstrong.

Inquiry No. 3333.—For manufacturers of heads and handles for feather dusters.

Inquiry No. 3334.—For manufacturers of a machine for assorting bristle hair.

Inquiry No. 3335.—For manufacturers of a machine for separating natural gas from water.

Inquiry No. 3336.—For manufacturers of chuck awls.

Inquiry No. 3337.—For manufacturers of light, portable printing presses.

Inquiry No. 3338.—For manufacturers of track velocipedes for railroad inspection.

Inquiry No. 3339.—For a machine for darning stockings.

Inquiry No. 3340.—For manufacturers of acetylene gas engines.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled

(8728) C. K. B. asks how to reduce old platinum for a toning solution for aristo platinum paper. A. Scrap platinum can only be dissolved in aqua regia. Aqua regia is a mixture of 3 parts of strong hydrochloric acid and 1 part strong nitric acid. After dissolving, evaporate off excess of acid and let the platinum chloride crystallize out.

(8729) E. N. asks: 1. Would you kindly inform me if paper could be made a conductor of galvanic electricity, and if so, how? A. Paper cannot be rendered a conductor, except by wetting it with some liquid which is an electrolyte, such as water to which acid or some salt of a metal has been added. 2. Is there any metal which has a white polish to it like silver? A. Tin and nickel will receive a polish like silver and will retain it longer in the air, since they do not oxidize as readily.

(8730) H. S. asks: Is banana oil made from fats and the above name given to it, or is there an oil extracted from bananas? To what uses can it be put? Also, is there a formula for its manufacture artificially? A. Banana oil is the name given to amyl acetate on account of its similarity in odor to bananas. It is manufactured commercially from fusel oil. Its chief use is for varnish solvent. Has a limited use as an artificial fruit flavor. Methods for making it can be found by consulting an organic chemistry.

(8731) E. G. asks: 1. Is there any definite point or degree of heat at which water turns into steam? A. Water turns into steam at the temperature of 212 deg. Fah. at mean atmospheric pressure. 2. Does this vary much or little under different pressures? A. Yes. Varies at a decreasing ratio from 3 deg. per pound at low pressure to 1.7 deg. at 50 pounds and 0.6 deg. at 100 pounds' pressure per square inch. 3. Is there any rule given on this subject, and if so where can it be obtained? A. Rules and formulæ for the properties of steam are given in Haswell's "Engineer's Pocket-Book." 4. Can steam at atmospheric pressure be colder than boiling water under high pressure without being condensed into water again? A. The temperature of steam is the same as that of the water, when confined with the water in a boiler at all pressures. Steam when released from pressure instantly expands, by which its temperature falls, and becomes colder than the water from which it was liberated. 5. Can water be made hotter than 212 deg. Fah. without turning into steam under high pressure? A. Water can be heated to any required temperature under the pressure due to the temperature, but not to a higher temperature than 212 deg. Fah. under atmospheric pressure.

(8732) E. L. C. asks: 1. What causes the sound made by placing the receiver over the transmitter, more noticeably on short lines, and does same injure the 'phone? A. The sound in the receiver when it is brought over the transmitter is due to induction. It cannot injure the receiver in any way so far as we can see. 2. A recipe for recharging old dry batteries which have given out? A. Dry cells are not really worth recharging. The small amount of zinc in a cell is probably mostly used up in the first life of the cell. If the metal of the outside of a dry cell is punched quite full of holes with a pointed tool, the cell may be put into a glass jar containing saturated solution of salammoniac and used as a wet cell for a while. 3. How many volts does the average medical induction coil give with one new dry cell, regulator out, giving the strongest current? A. We do not know the voltage of a medical coil under the circumstances you describe. No two would probably have the same voltage. The only way to determine the voltage would be to measure it, in the special case. 4. How much does it cost to recharge the improved Fuller battery, and how long will same last: the battery working about one-fourth the time? A. The parts of a Fuller bichromate cell can be purchased from manufacturers of electrical supplies. 5. How many C. P. does the No. 1 burner of a coal oil lamp give? A. The candle-power of a burner cannot be given except by measuring it.

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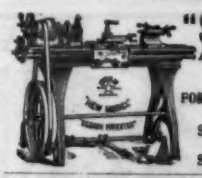

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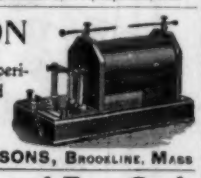

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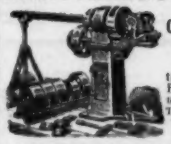

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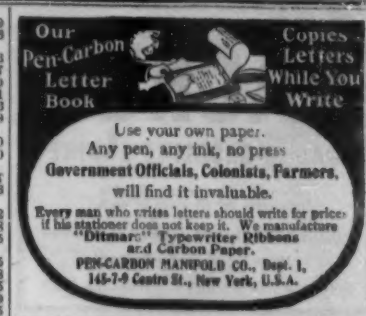

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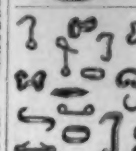

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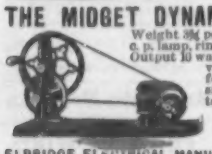

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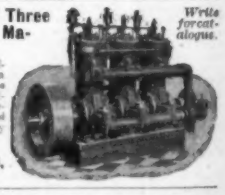

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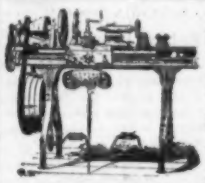

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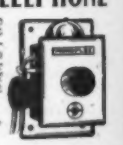

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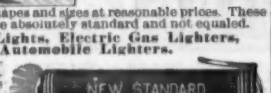

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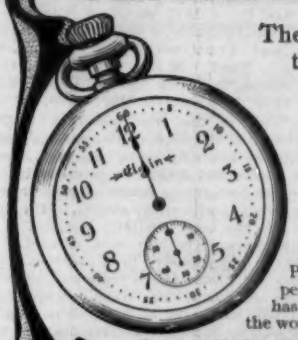

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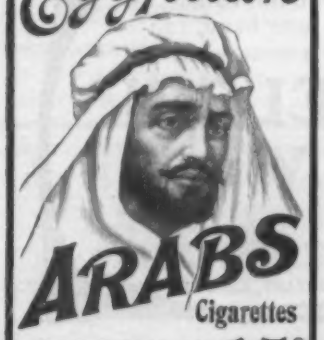
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SUBMARINE WARFARE, PAST, PRESENT AND FUTURE. By Herbert C. Fyfe. With an Introduction by Admiral the Hon. Sir Edmund Robert Fremantle, G.C.B., C.M.G., and a Chapter on The Probable Future of Submarine Boat Construction, by Sir Edward J. Reed, M.P. London: Grant Richards. New York: D. P. Dutton. 1902. Pp. xxviii, 332. 8vo.

In view of the great attention that has been given to the subject of submarine warfare during the last fifty years, and more particularly in the last decade, it is surprising that there has been such a dearth of popular literature dealing with this subject. The want, however, has been admirably supplied by the present work. The only book devoted to the subject is one published by a lieutenant of the Danish navy, some fifteen years ago, but as the modern submarine has been developed since that date, the pages of Mr. Fyfe's work will have all the interest that attaches to a thoroughly novel treatise. The text of this work is clearly written and the subject is fully illustrated with halftone engravings and line cuts, showing the submarine torpedo boat both ashore and afloat. The frontispiece is a fine engraving showing the Russian battleship "Retvisan" and the United States submarine boat "Holland" in drydock at the same time. There are chapters of the book devoted to a description of the modern British and United States submarine, which is practically the same thing as saying that they are devoted to the description of the "Holland" boat, as this type is being used with practically little variation by both navies. Excellent chapters are those entitled "The Morality of Submarine Warfare," and "The Submarine in Action," the latter dealing with the actual experience as gained with these craft. Due credit is given to the efforts of early inventors, and a whole chapter is given to the submarine during America's civil war. The work can be cordially recommended to those who wish to be in touch with the latest developments of this type of war craft.

WIND VELOCITY AND FLUCTUATIONS OF WATER LEVEL ON LAKE ERIE. Prepared under the direction of Willis L. Moore, Chief of U. S. Weather Bureau. By Alfred J. Henry, Professor of Meteorology. Washington: Government Printing Office. 1902.

METEOROLOGICAL OBSERVATIONS MADE AT THE PERTH OBSERVATORY AND OTHER PLACES IN WESTERN AUSTRALIA DURING THE YEAR 1900. Under the direction of W. Ernest Cooke, M.A., F.R.A.S., Government Astronomer. Perth. 1901. Pp. 121.

THE EASTERN OBLIQUE ARC OF THE UNITED STATES AND OSCULATING SPHEROID. By Charles A. Shott, U. S. Coast and Geodetic Survey. Special Publication No. 7. Washington: Government Printing Office. 1902. Pp. 393.

NOTES ON FORTIFICATION WITH A SYNOPTICAL CHART. By Major B. R. Ward, R.E. New York: E. P. Dutton & Co. London: John Murray. 1902. 8vo. Pp. 50. Price $2.

ANNALS OF THE ASTRONOMICAL OBSERVATORY OF HARVARD COLLEGE. Edward C. Pickering, Director. Vol. XXXVIII. A Discussion of Variable Stars in the Cluster ω Centauri. By Solon I. Bailey, Associate Professor of Astronomy. Cambridge, Mass.: Published by the Observatory. 1902. Quarto. Pp. 252.

STUDIES IN HETEROGENESIS. By H. Charlton Bastian. Part II. London and Edinburgh: Williams & Norgate. Large 8vo. Pp. 147, xvii. Price $1.50.

SUBJECT LIST OF WORKS ON DOMESTIC ECONOMY, FOODS AND BEVERAGES. Including the culture of cacao, coffee, barley, hops, sugar, tea and the grape. In the Library of the Patent Office, London. 1902. Pp. 136.

ELEMENTARY COAL MINING. By George L. Kerr, M.E., M. Inst.M.E. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Company. 1902. Pp. 225. 16mo. Price $1.25.

This book is an abridged edition of Kerr's "Practical Coal Mining," and was published with the view of meeting the requirements of those commencing the study of mining. No doubt the book will probably also be of service to miners and workmen who may desire to obtain some theoretical knowledge of their work.

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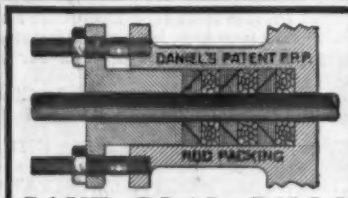

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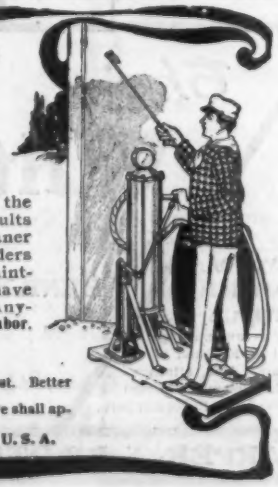

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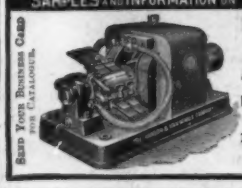

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